# CHAPTER 1

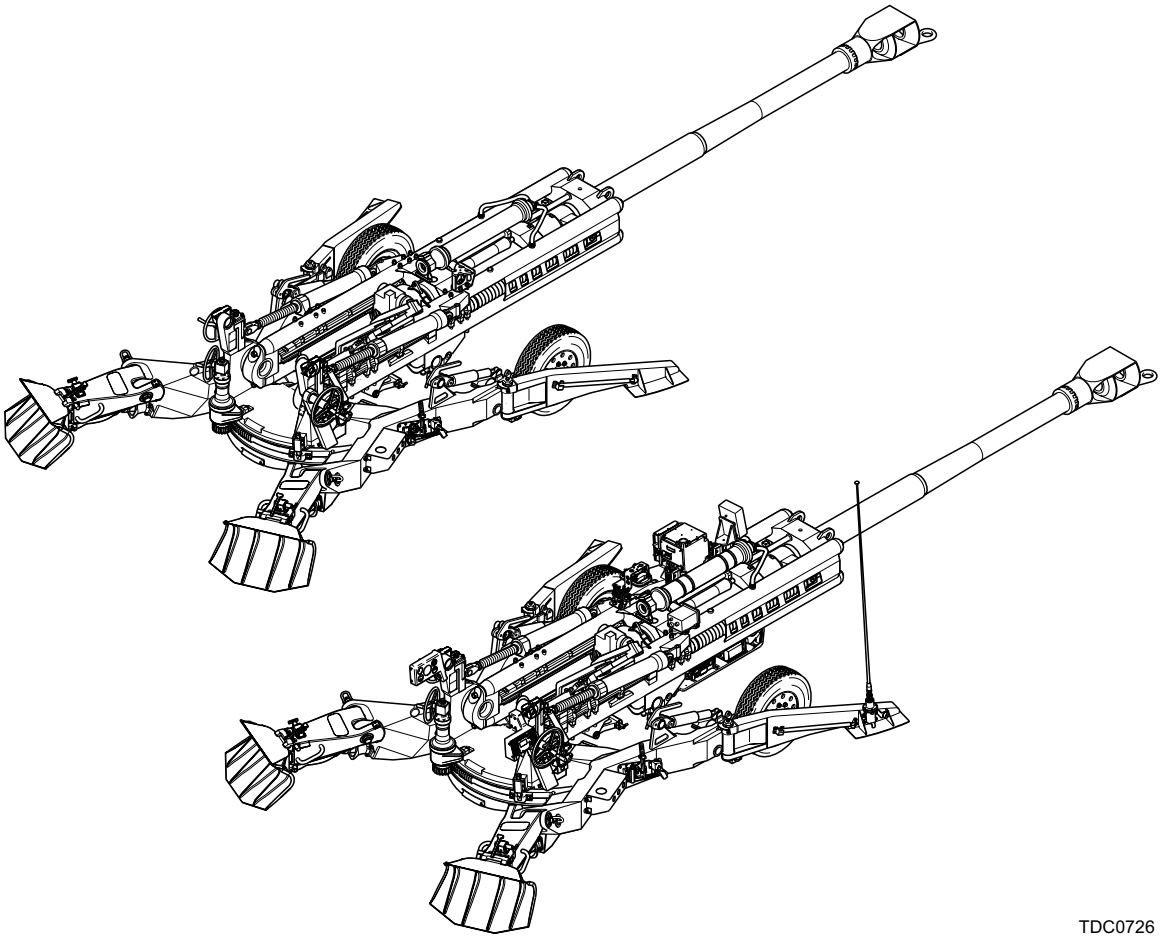
# INTRODUCTION

**Section Index**



## Section I. GENERAL INFORMATION





TDC0726

## 1-1 SCOPE

This manual tells the howitzer crew how to operate and maintain the howitzer in the field. It also includes training procedures.

**a. Type of Manual.** Operator's Manual.

**b. Model Number and Equipment Name.** Howitzer, Medium, Towed 155mm, M777/M777E1.

**c. Purpose of Equipment.** To provide artillery fire in support of ground gaining troops.

**d. Special Inclusions in Manual.** This manual includes section drill procedures as detailed in Section IV.

## 1-2 MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps personnel will use TM 4700-15/1, Equipment Record Procedures.

## 1-3 HAND RECEIPT (HR) MANUALS

This manual has a companion document with a TM number followed by "HR" (which stands for Hand Receipt). The TM 9-1025-215-10-HR consists of pre-printed hand receipts (DA Form 2062) that list end item related equipment (i.e. COEI, BII and AAL) that must be accounted for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 25-30:

Commander
US Army Publications Distribution
Center-St. Louis
ATTN: SFIS-APC-S-OC
1655 Woodson Road
St. Louis, MO 63114-6181

## 1-4 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS

If your howitzer needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a SF 368 (Product Quality Deficiency Report). Mail it to us at: ATTN: AMSTA-AR-QAW-C, TACOM-ARDEC, 1 Rock Island Arsenal, Rock Island, IL 61299-7300 (FAX: Commercial (309) 782-6653, DSN 793-6653 (E-mail: qawqdrs@ria.army.mil. Marine Corps users submit a Product Quality Deficiency Report (SF 368) in accordance with MCO 4855. 10, Product Quality Deficiency, and TM 4700-15/1, Equipment Record Procedures, to: Commanding General, ATTN: Code (808-1), Marine Corps Logistics Base, 814 Radford Blvd, Albany, GA 31704-1128. We'll send you a reply.

## 1-5 CORROSION PREVENTION AND CONTROL

**a.** Corrosion Prevention and Control (CPC) of service materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

**b.** While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using SF 368, Product Quality Deficiency Report. Use of key words such as "corrosion", "rust", "deterioration," or "cracking" will assure that the information is identified as a CPC problem. Submit the form to: ATTN: AMSTA-AR-QAW-C, TACOM-ARDEC, 1 Rock Island Arsenal, Rock Island, IL 61299-7300 (FAX: commercial (309) 782-6653, DSN 793-6653 (E-mail: qawqdrs@ria.army.mil. Marine Corps users submit a Product Quality Deficiency Report (SF 368) to: Commanding General, ATTN: Code (808-1), Marine Corps Logistics Base, 814 Radford Blvd, Albany, GA 31704-1128.

## 1-6 NOMENCLATURE CROSS-REFERENCE LIST

This listing includes the nomenclature cross-reference list, list of abbreviations/acronyms, and explanation of terms (glossary) used in this manual.

| HOWITZER COMMON NAMES | OFFICIAL NOMENCLATURE |
|---|---|
| Breech lever | Breech operating valve lever |
| Breech crank locking pin | Quick release pin |
| Cannon tube | Ordnance |
| Emergency hose assembly | Hose assembly |
| Equilibrator | Balancer |
| Equilibrator and lines | Balancer and pipework |
| Equilibrator Indicator | Balancer adjusting indicator |
| Firing lever | Remote firing lever |
| Firing Mech | M54 Firing Mechanism |
| Handbrakes | Left and right manual brake assemblies |
| Loading tray lever | Loading tray control valve lever |
| Lunette | Towing eye |
| Obturator | Bolt vent axial |
| Oil index pin | Tell-tale rod |
| Pantel | M137A2 panoramic telescope |
| Rear shell roller | Rear projectile roller |
| Recoil accumulator | Recuperator |
| Recoil cylinders | Buffer cylinders |
| Recoil yoke | Buffer yoke |
| Scavenge isolator valve | Scavenge system isolator valve |
| Service airline | Hose airline |
| Spade damper lever | Spade damper lockout lever |
| Suspension lever | Suspension operating valve lever |
| Trunnion pump | Trunnion pump adaptor |
| Travel locks | Elevation travel locks |
| Wheel locking lever | Wheel axle arm locking plunger |

## 1-7 LIST OF ABBREVIATIONS/ACRONYMS

**a.** The following alphabetical list gives definitions for the abbreviations and acronyms used for the howitzer.

| | |
|---|---|
| AAL | Additional Authorization List |
| ADAM | Area Denial Artillery Munition |
| AG | Assistant Gunner |
| ASP | Ammunition Supply Point |
| AZ | Azimuth |
| ATC | Ammunition Team Chief |
| BE | Base Ejection |
| BII | Basic Issue Items |

## 1-7 LIST OF ABBREVIATIONS/ACRONYMS (cont)

CA ..... Canada
CASP ..... Chemical Ammunition Supply Point
CCW ..... Counter Clock Wise
CHG ..... Charge
CLGP ..... Cannon Launched, Guided Projectile
CLP ..... Cleaner, Lubricant and Preservative
COEI ..... Components of End Item
CP ..... Concrete-Piercing
CPC ..... Corrosion Prevention and Control
CTA ..... Complete Table of Allowances
CW ..... Clock Wise
D ..... Driver
DA ..... Denmark
DAP ..... Distant Aiming Point
DLY ..... Delay
DODIC ..... Department of Defense Identification Code
DP ..... Dual Purpose
DS ..... Direct Support
ECCM ..... Electronic Counter Counter Measures
EFC ..... Equivalent Full Charge
EL ..... Elevation
EIRs ..... Equipment Reporting Improved Recommendations
EOD ..... Explosive Ordnance Disposal
ERLS ..... Elimination Radioactive Luminations Source
ET ..... Electronic Time
FAST ..... Fast Azimuth Shift Tool
FAPP ..... Field Artillery Projectile Pallet
FDC ..... Fire Direction Center
FMTV ..... Family of Military Vehicles
FPF ..... Final Protective Fire
FR ..... France
FRBC ..... Flexible Rotating Band Cover
FZ ..... Fuze
G ..... Gunner
GB ..... Nerve Agent, Non-Persistent
GB ..... Green Bag
GE ..... Germany
GMD ..... Grease Molybdenum Disulphide
GR ..... Greece
H ..... Mustard Gas
HC ..... White Smoke Canisters
HD ..... Distilled Mustard Gas
HE ..... High Explosive
HEAT ..... High-Explosive, Anti-Tank
HERA ..... High Explosive, Rocket Assisted
HP ..... High Pressure
ICM ..... Improved Conventional Munitions
IT ..... Italy
LAW ..... All Weather, Lubricant
LCD ..... Liquid Crystal Display
LP ..... Low Pressure
LPRS ..... Loose Projectile Restraint System
MACS ..... Modular Artillery Charge System
MOFA ..... Military Operations
MOUT ..... Military Operations Urban Terrain

MT.....Mechanical Time
MTSQ.....Mechanical Time and Super Quick
MTVR.....Military Tactical Vehicle Replacement
MVS.....Muzzle Velocity System
NATO.....North Atlantic Treaty Organization
NBC.....Nuclear Biological Chemicals
NL.....Netherlands
NO.....Norway
PIAFS.....Portable Inductive Artillery Fuze Setter
PFM.....Primer Feed Mechanism
OFC.....Optical Fire Control
PD.....Point Detonating
PMCS.....Preventative Maintenance Checks and Services
POC.....Platoon Operations Command
RAAMS.....Remote Anti-Armor Mine System
RAP.....Rocket Assisted Projectile
RB.....Red Bag
RF.....Radio Frequency
RPM.....Revolutions Per Minute
S&A.....Safe & Arming Mechanism
SADARM.....
SC.....Section Chief
SOP.....Standard Operating Procedure
SQ.....Super Quick
TI.....Time
TNT.....Trinitrotoluene Nitrate Toluene
TWD.....Thermal Warning Device
UK.....United Kingdom
USMC.....United States Marine Corps
VHF.....Very High Frequency
VT.....Variable Time
VX.....Nerve Agent Persistent
WB.....White Bag
W/SUPPL.CHG.....With Supplementary Charge
VX.....Persistent toxic casualty nerve gas
WP.....White Phosphorous

**b.** The following alphabetical list gives definitions for the abbreviations and acronyms used for the DFCS system.

AGD.....Assistant Gunners Display
AMP.....Radio Amplifier
ANT.....Radio Antenna
BAT.....Battery
BIT.....Built in Test
BTT.....Battery Temperature Sensor
CLA.....Communication Location Assembly
CLE.....Communication Location Enclosure
CSD.....Chief of Section Display
DFCS.....Digital Fire Control System
GND.....Gunners Display
GPS.....Global Positioning System
LCD.....Liquid Crystal Display
LED.....Light Emitting Diodes
MSC.....Mission Computer
PLA.....Remote PLGR Antenna
PLGR.....Precision Lightweight GPS Receiver

## 1-7 LIST OF ABBREVIATIONS/ACRONYMS (cont)

PNS ..... Position Navigation Unit
PSP ..... Power Control and Conditioning Module
RTA ..... Radio Transceiver
SCCDU ..... Section Chief Control and Display Unit
SOC ..... State Of Charge
SINCGARS ..... Single Channel Ground and Airborne Radio System
VMS ..... Vehicle Motion Sensor

## 1-8 GLOSSARY

The following is an alphabetical listing of terms with definitions used in this manual. These terms need explanation and are not defined within the text.

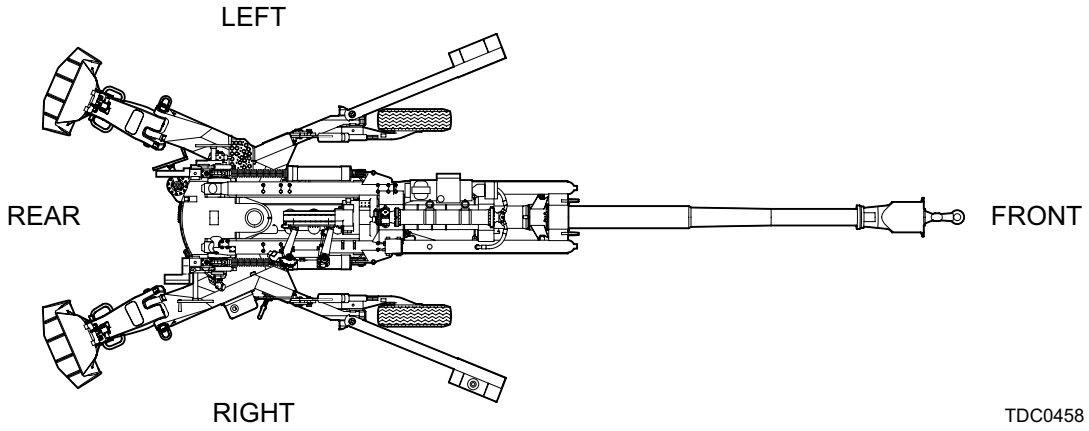
**a. Front of Howitzer.** The muzzle end of the howitzer.

**b. Howitzer Section.** Those personnel specified by the current table of organization and equipment that make up the howitzer section.

**c. Left Side of Howitzer**. At a person's left-hand side when standing at the breech end of the howitzer, facing toward the cannon muzzle.

**d. Rear of Howitzer.** The breech end of the howitzer.

**e. Right Side of Howitzer.** At a person's right-hand side when standing at the breech end of the howitzer, facing toward the cannon muzzle.




## 1-9 WARRANTY INFORMATION

Not Applicable

# SECTION II. EQUIPMENT DESCRIPTION

**Section Index**



## 1-10 EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

**a.** The howitzer provides general support field artillery firing for light divisions by providing both nuclear and nonnuclear firing.

**b.** The howitzer is an extended range weapon that can be towed by any four-wheel drive vehicle over 2.5 tons. The howitzer is also transportable by rotary and fixed wing aircraft. The body has trails, spades, and stabilizers that can be folded for transportation and storage.

**c.** The Optical Fire Control (OFC) equipment may be used by one or two crewmen for direct or indirect fire. The Gunner on the left side controls left and right (traversing) settings and the Assistant Gunner on the right side controls elevation and depression settings. The equipment can also be operated by a Gunner on the left side controlling both traversing and elevation settings.

**d.** All vials, reticles, and counters on the OFC and accessory equipment are illuminated by battery powered Light Emitting Diodes (LED) and Elimination Radioactive Light Source (ERLS).

**e.** The Digital Fire Control System (DFCS) is a computer based indirect fire control solution for the M777E1 howitzer. DFCS provides:

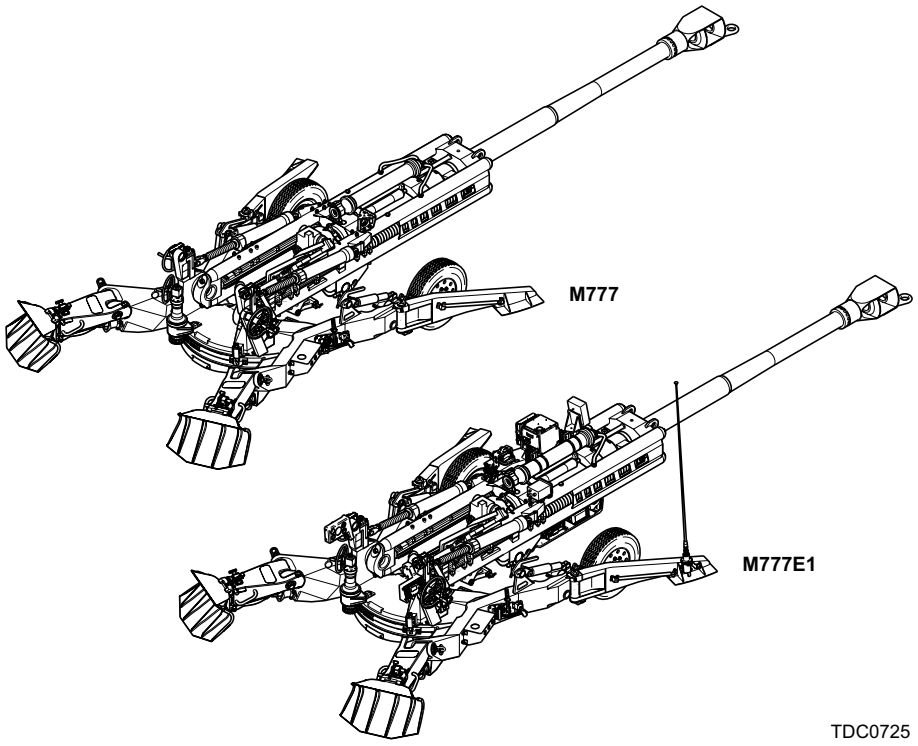
- Gun location.
- Pointing.
- Navigation.
- Digital communications.
- Emplacement/displacement aid capability.

**f.** The howitzer has a low profile, may be emplaced rapidly, and has a 6400-mil speed shift assembly.

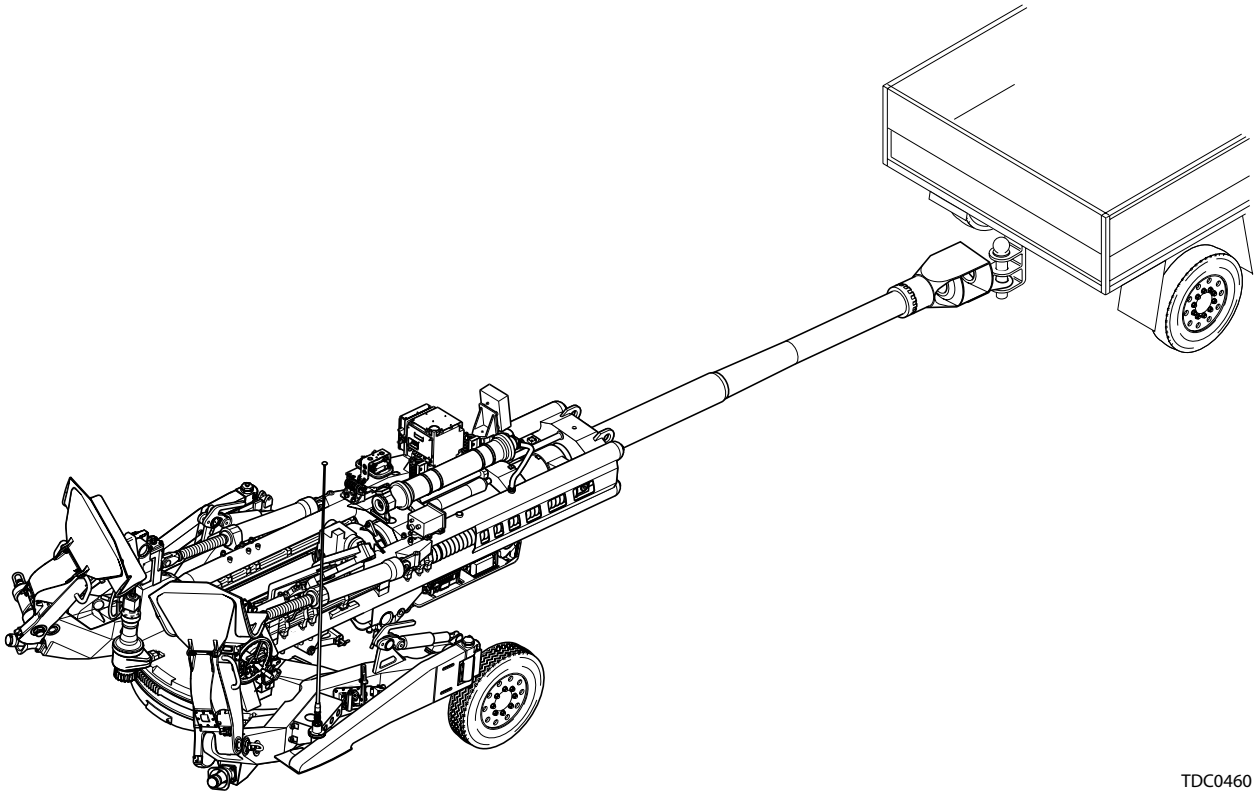
## 1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

**a.** Howitzer Positions. The firing and towed positions respectively, for the howitzer, are illustrated as follows:

## 1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

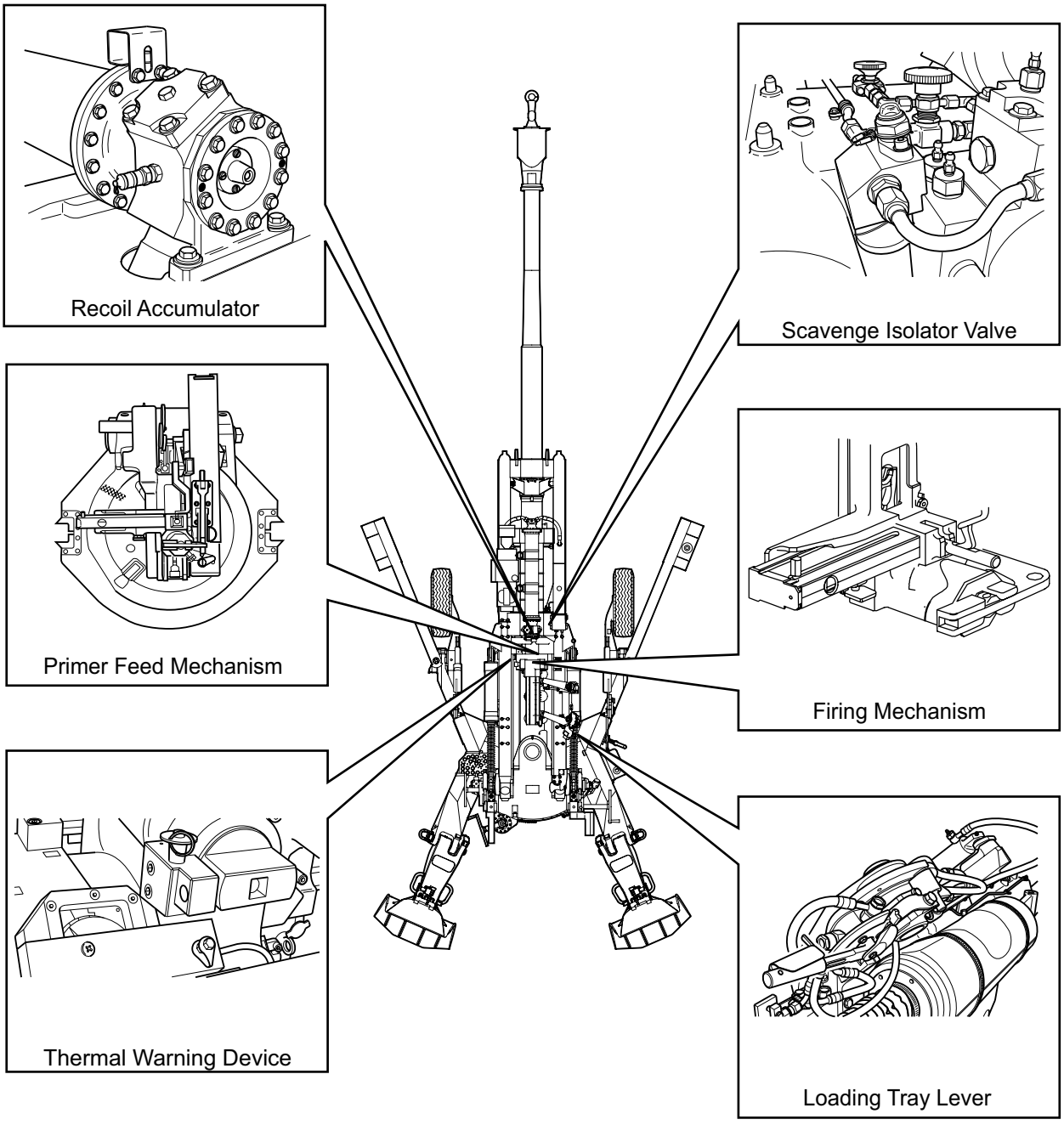



**FIRING POSITION**

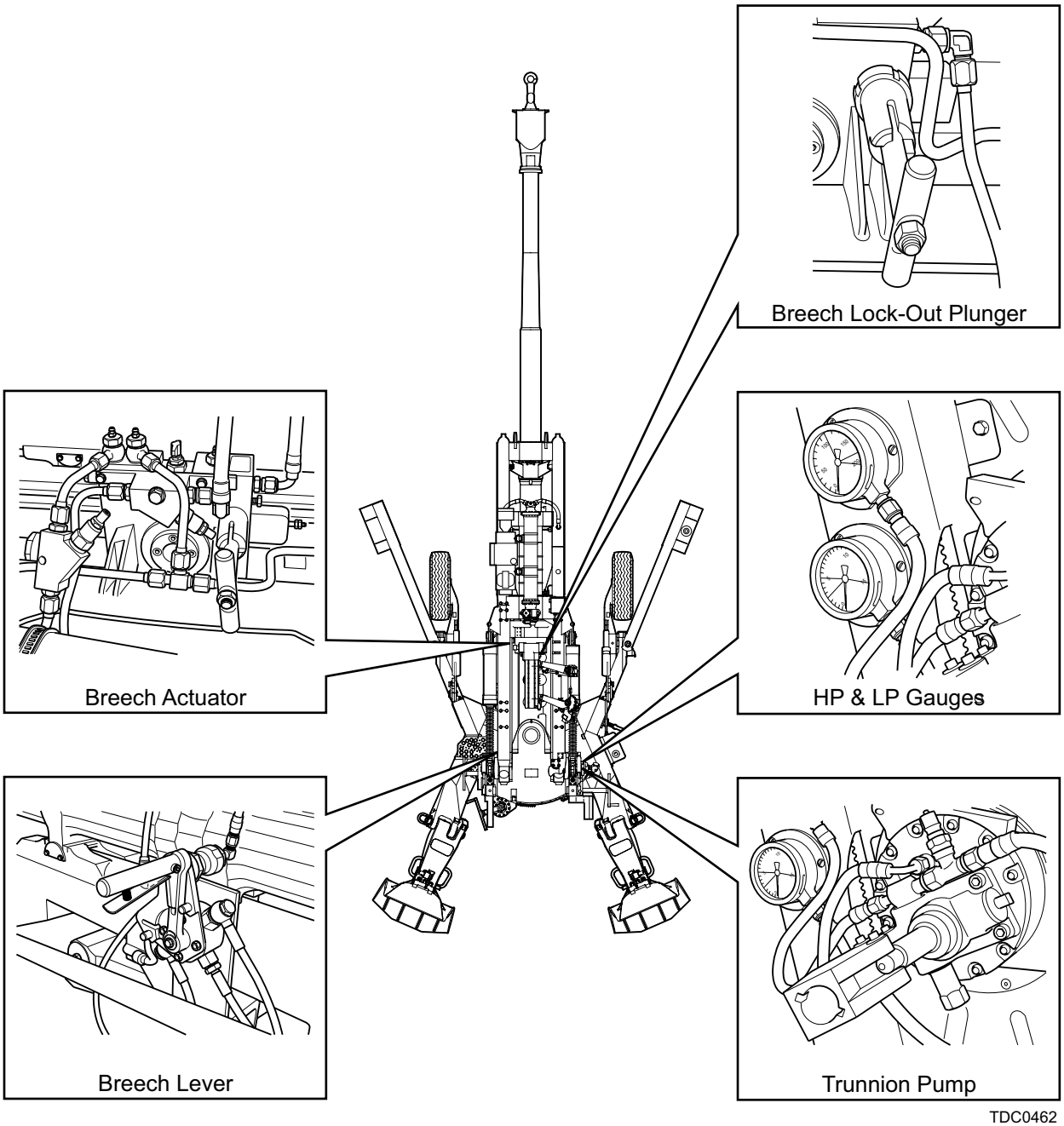


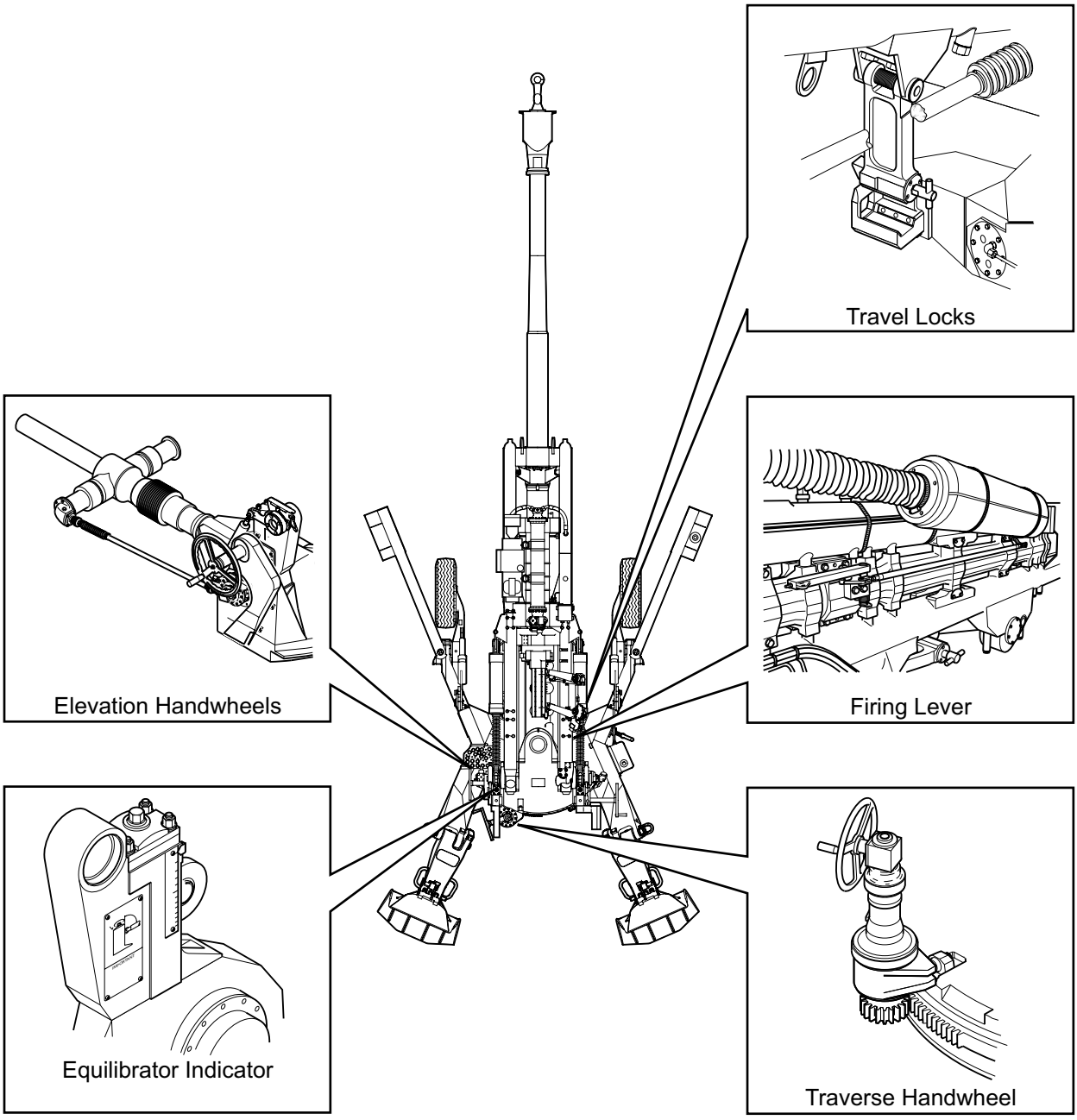

**TOWED POSITION**

**b.** Howitzer Components. Familiarize yourself with the components of the howitzer as detailed in the following illustrations: (Controls and Indicators are described in Chapter 2).

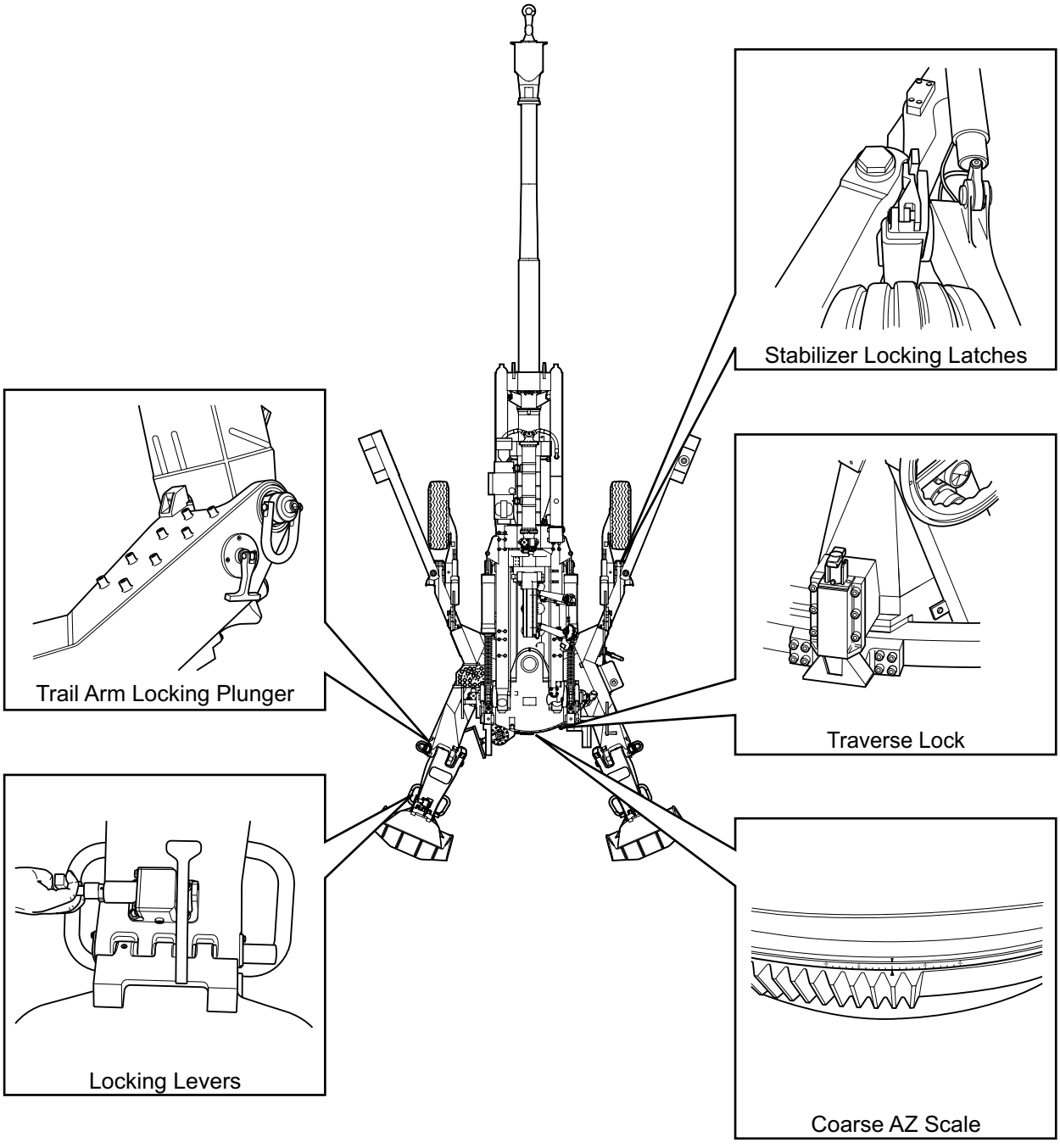


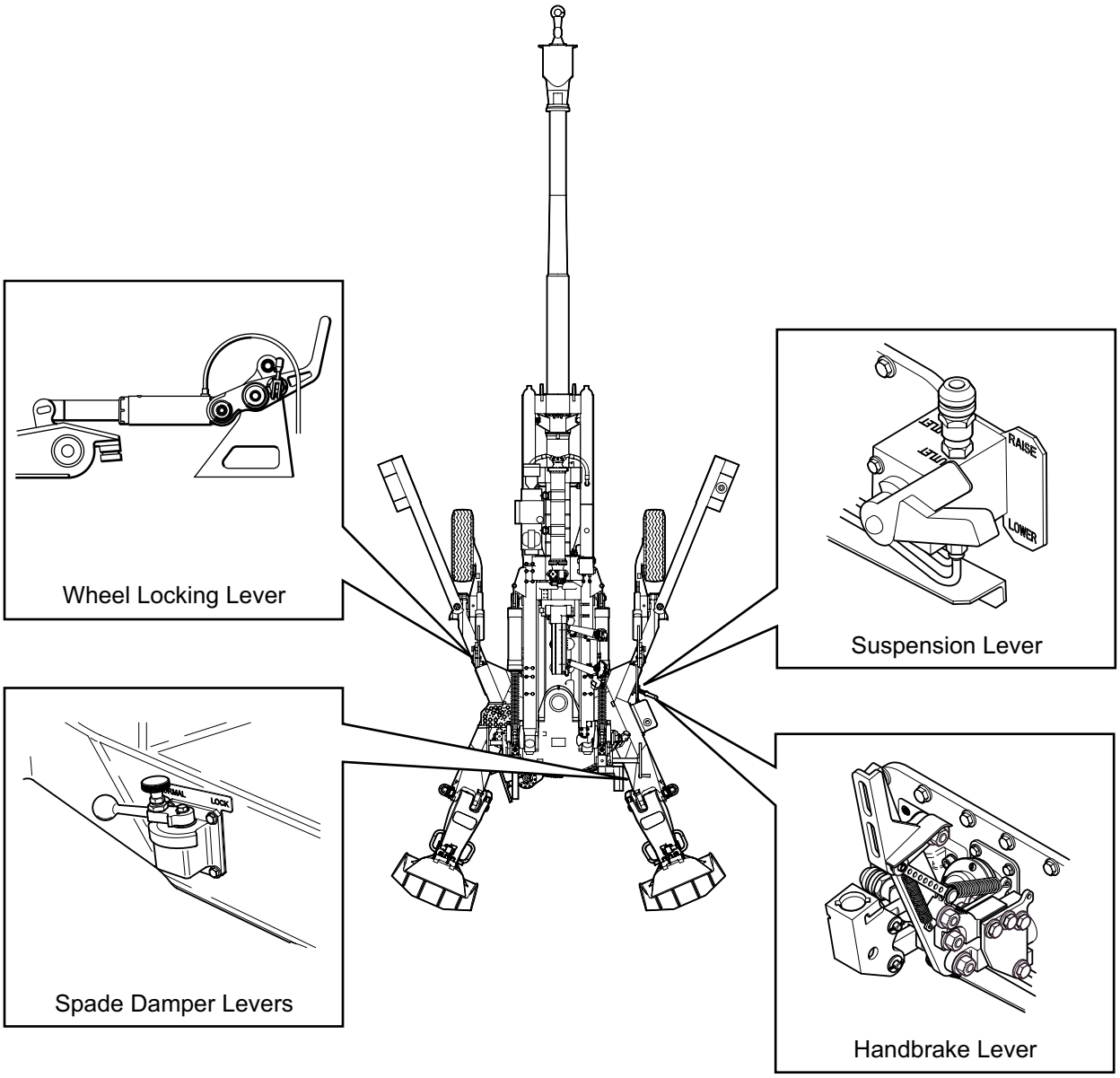
## 1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)




Travel Locks
Elevation Handwheels
Firing Lever
Equilibrator Indicator
Traverse Handwheel
TDC0463

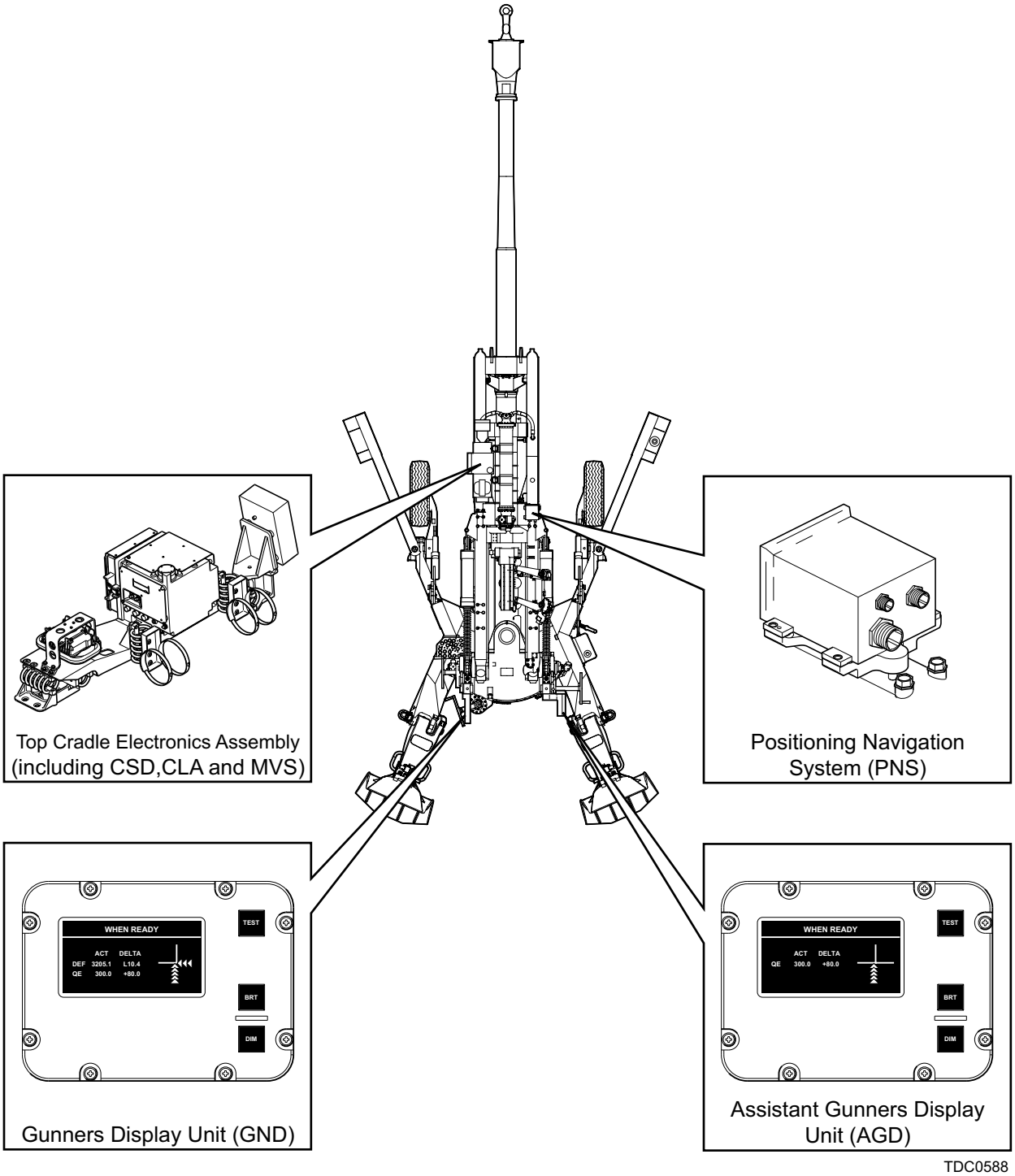
## 1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

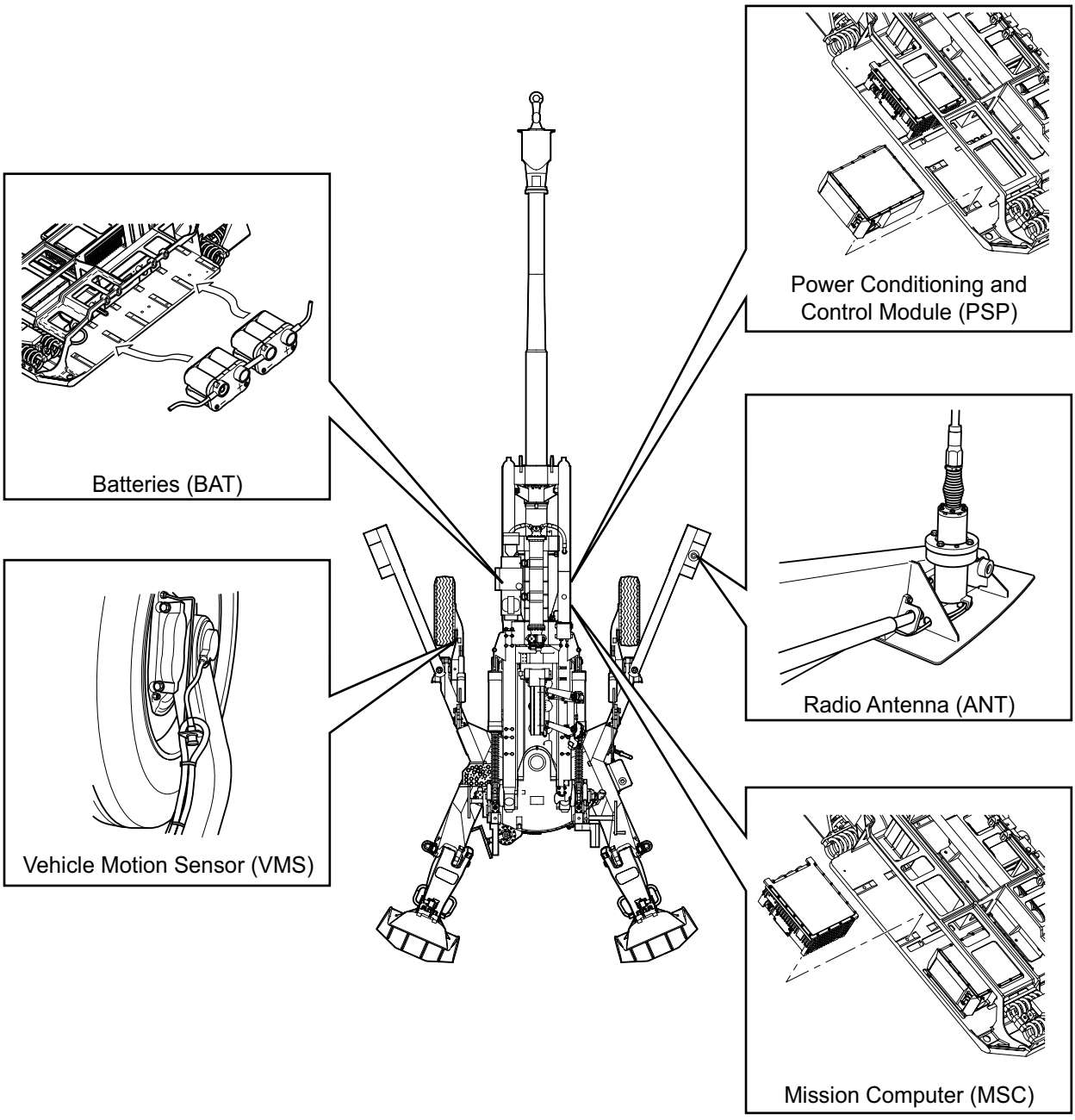



Wheel Locking Lever
Suspension Lever
RAISE
LOWER
Spade Damper Levers
NORMAL
LOCK
Handbrake Lever

TDC0465

## 1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)




Batteries (BAT)
Power Conditioning and Control Module (PSP)
Vehicle Motion Sensor (VMS)
Radio Antenna (ANT)
Mission Computer (MSC)

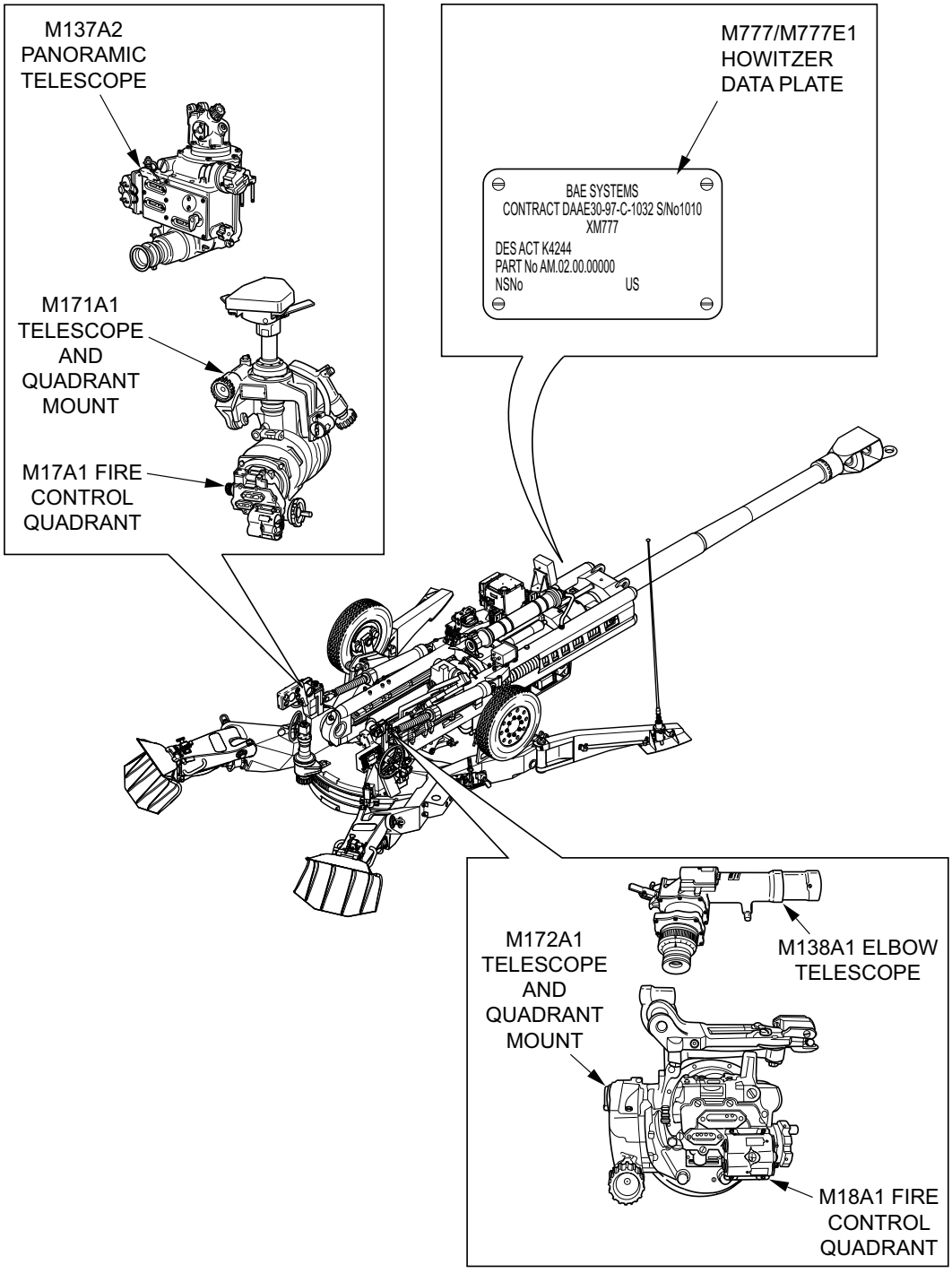
TDC0589

## 1-12 MODIFICATION AND SYSTEM IMPROVEMENT PACKAGE

Not Applicable

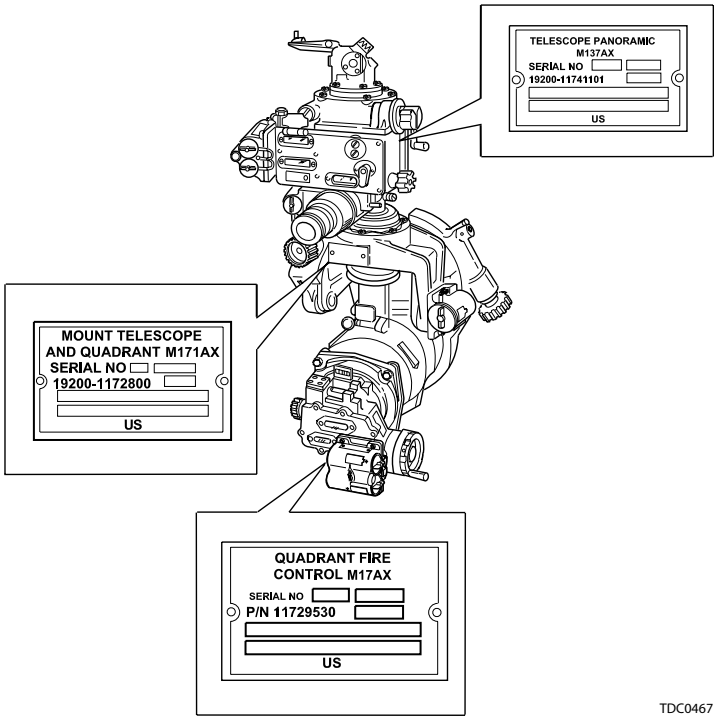
## 1-13 DATA PLATES

**a.** For location of data plates, refer to the following illustrations:

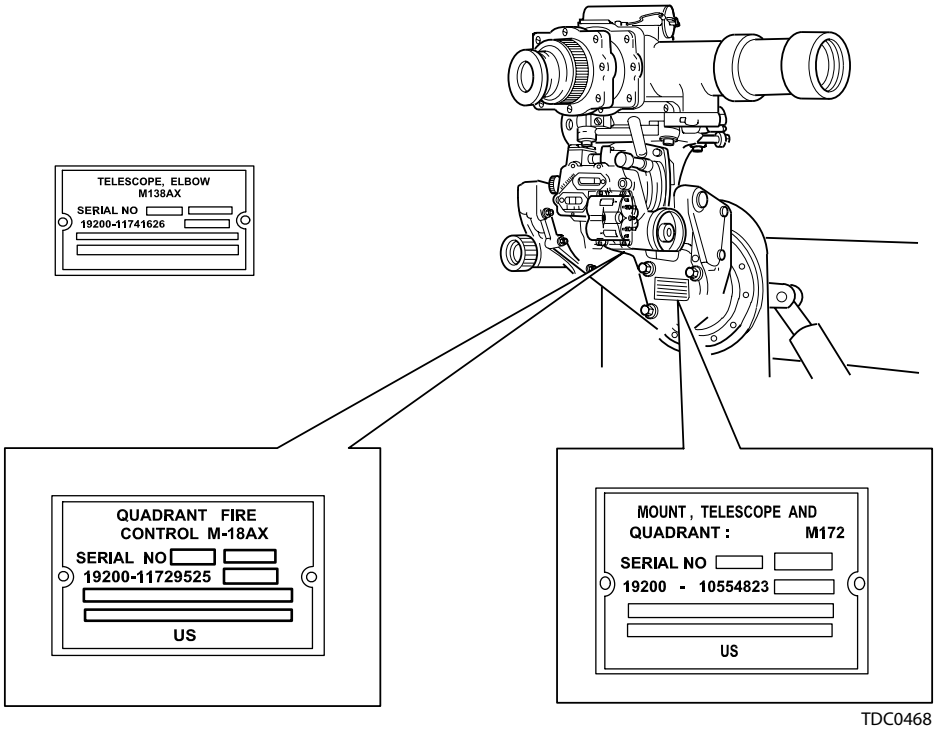



TDC0466

**(1)** Left-hand sight post.

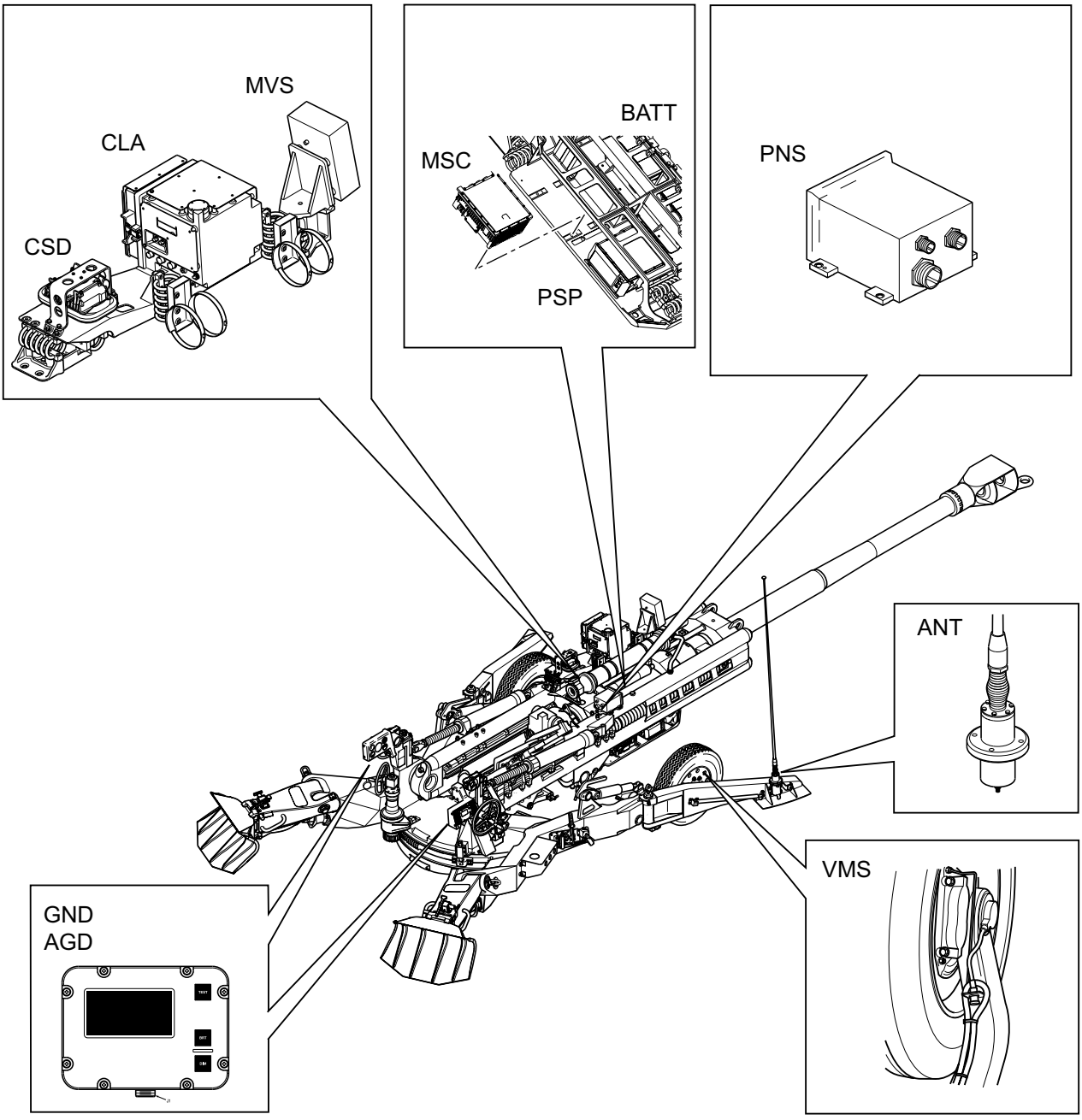



**(2)** Right-hand sight post.



## 1-14 M777E1 HOWITZER DFCS CABLE ROUTING IDENTIFICATION

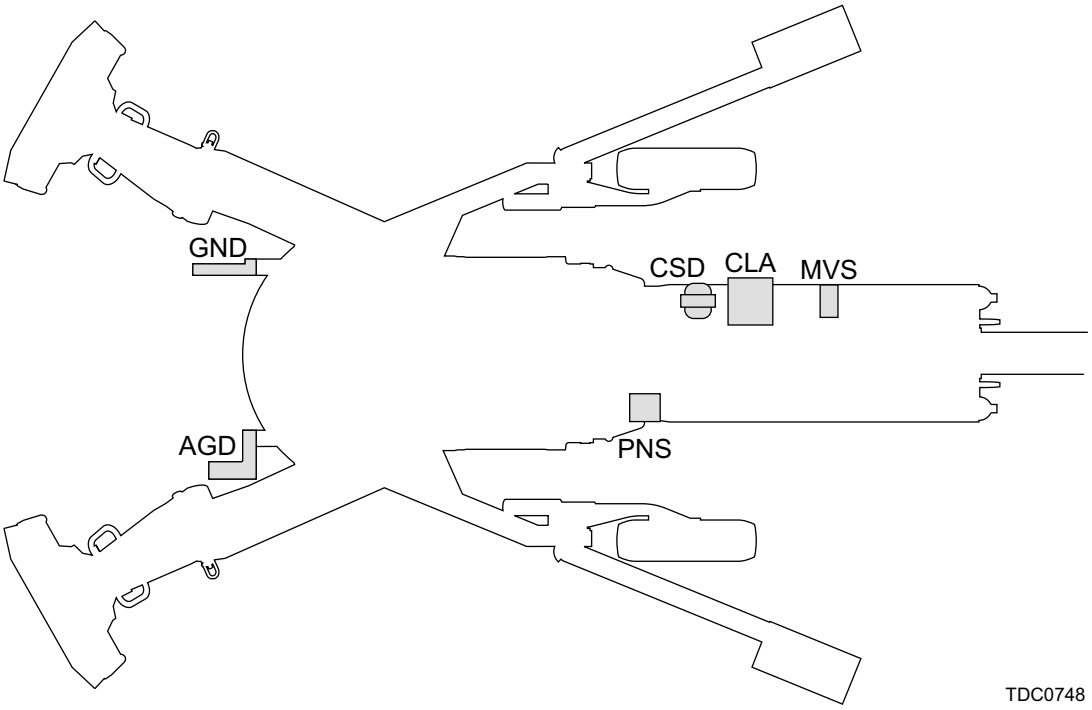
**a.** For location of DFCS components, refer to the following illustration:




TDC0729

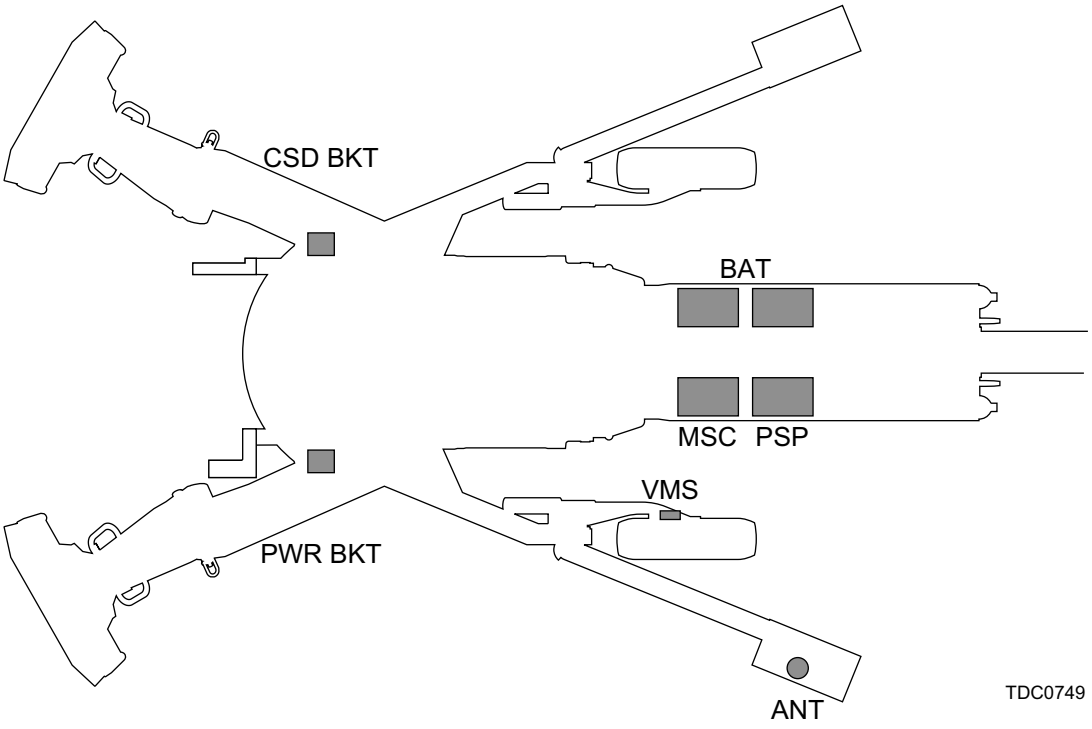
**b.** For identification and location of top carriage M777E1 howitzer DFCS, refer to the following illustration:

**Top Carriage M777E1 Howitzer DFCS**




**c.** For identification and location of bottom carriage M777E1 howitzer DFCS, refer to the following illustration:

**Bottom Carriage M777E1 Howitzer DFCS**

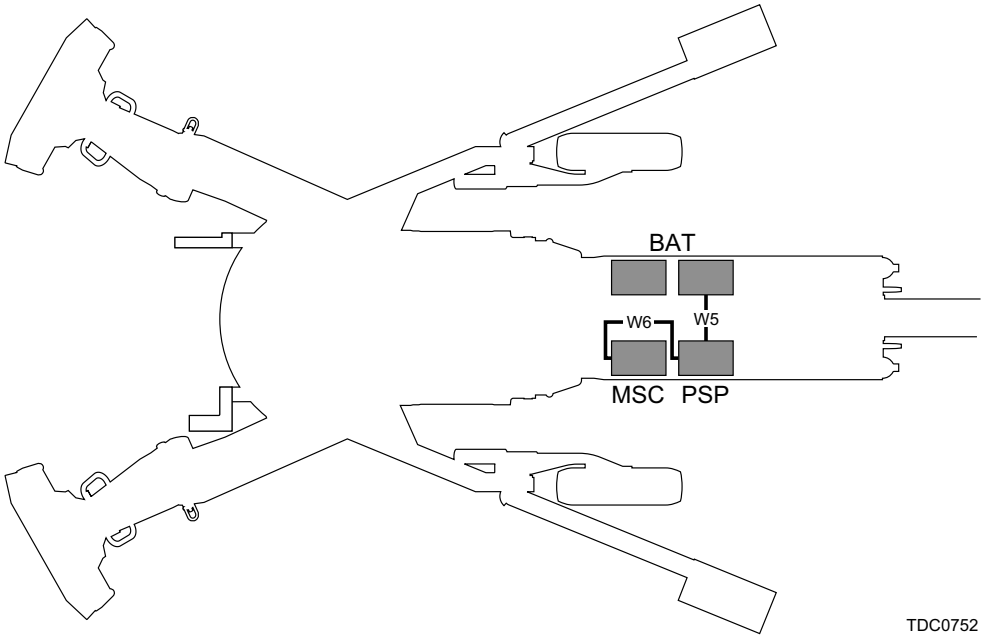


## 1-14 M777E1 HOWITZER DFCS CABLE ROUTING IDENTIFICATION (cont)

**d.** For identification and location of M777E1 howitzer DFCS cable routing, refer to the following illustrations:

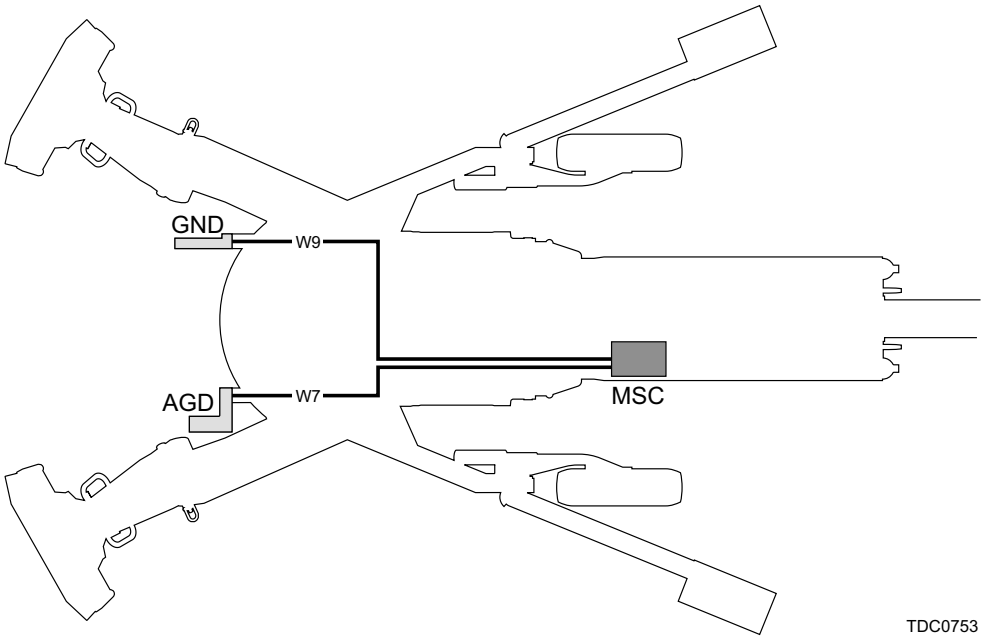
**(1)** [W5] cable – BAT to PSP.

**(2)** [W6] cable – MSC to PSP.

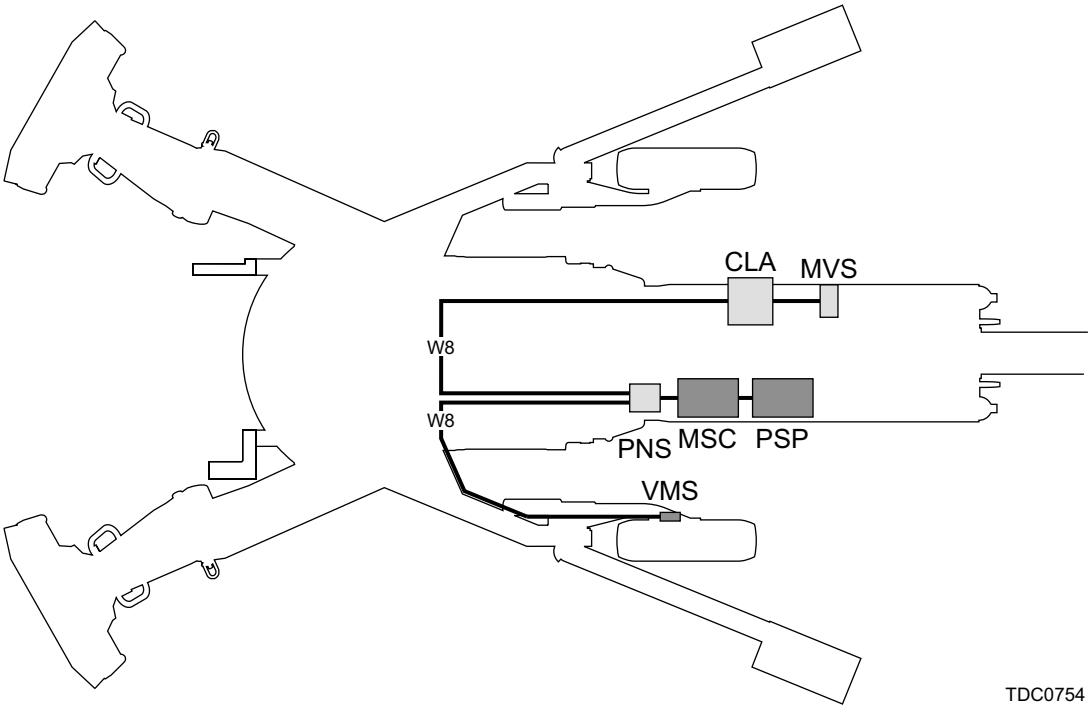



**(3)** [W7] cable – AGD to MSC.

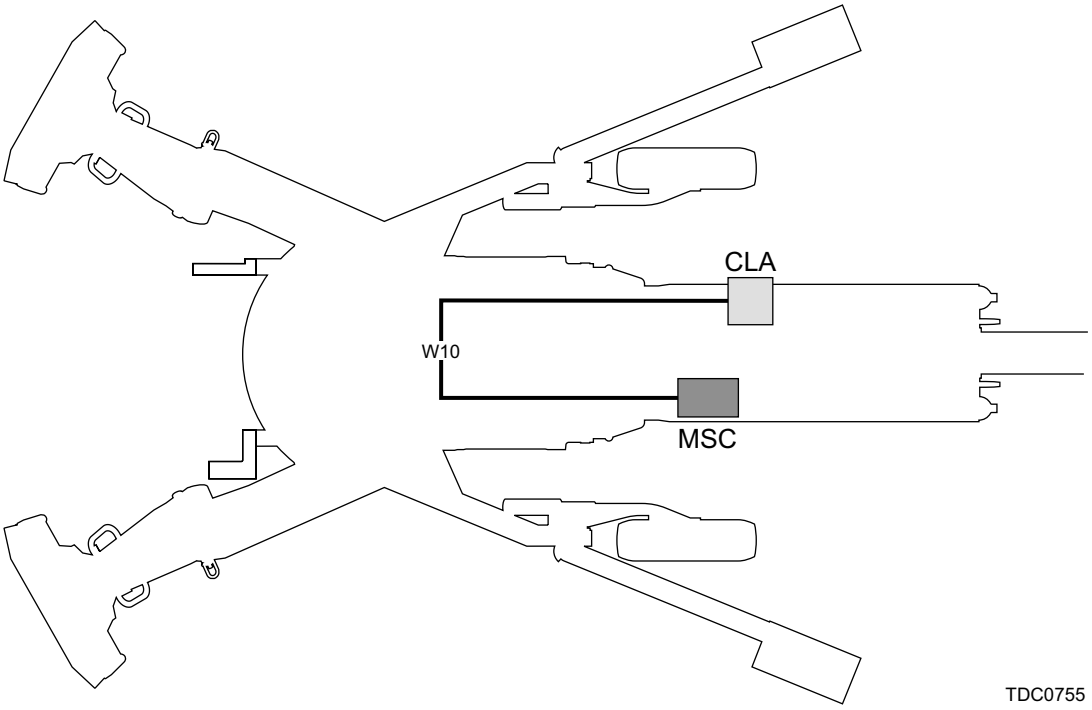
**(4)** [W9] cable – GND to MSC.



**(5)** [W8] cable – PNS/VMS and CLA/MVS to PSP/MSC.

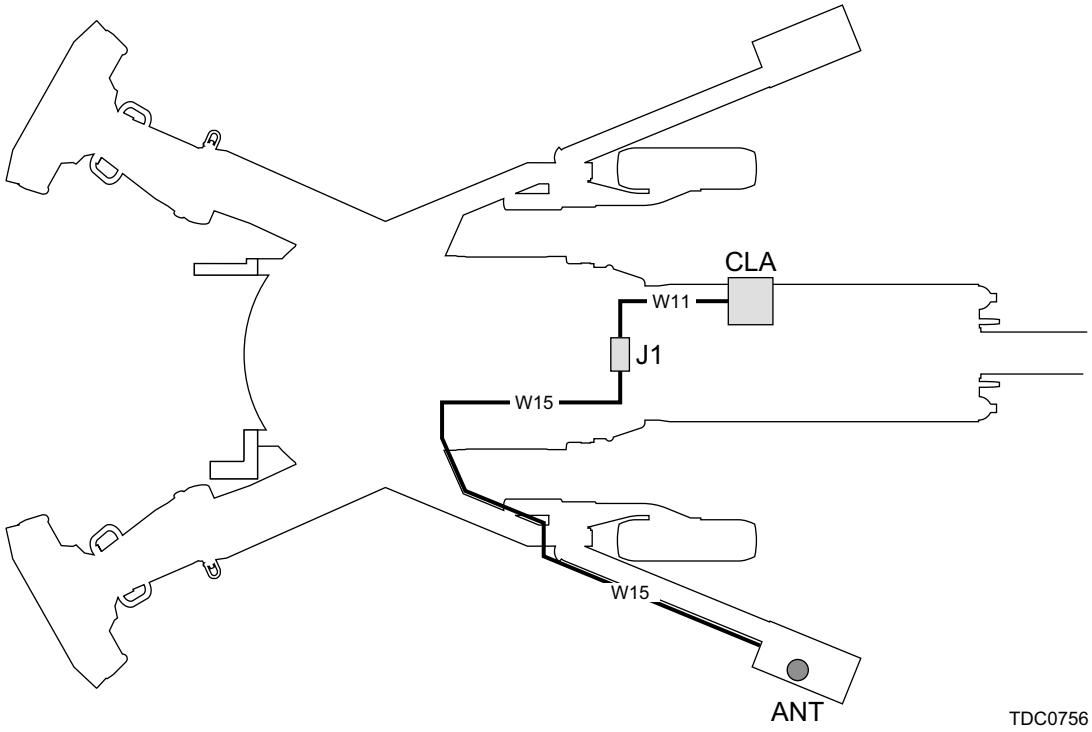



**(6)** [W10] cable – CLA to MSC.

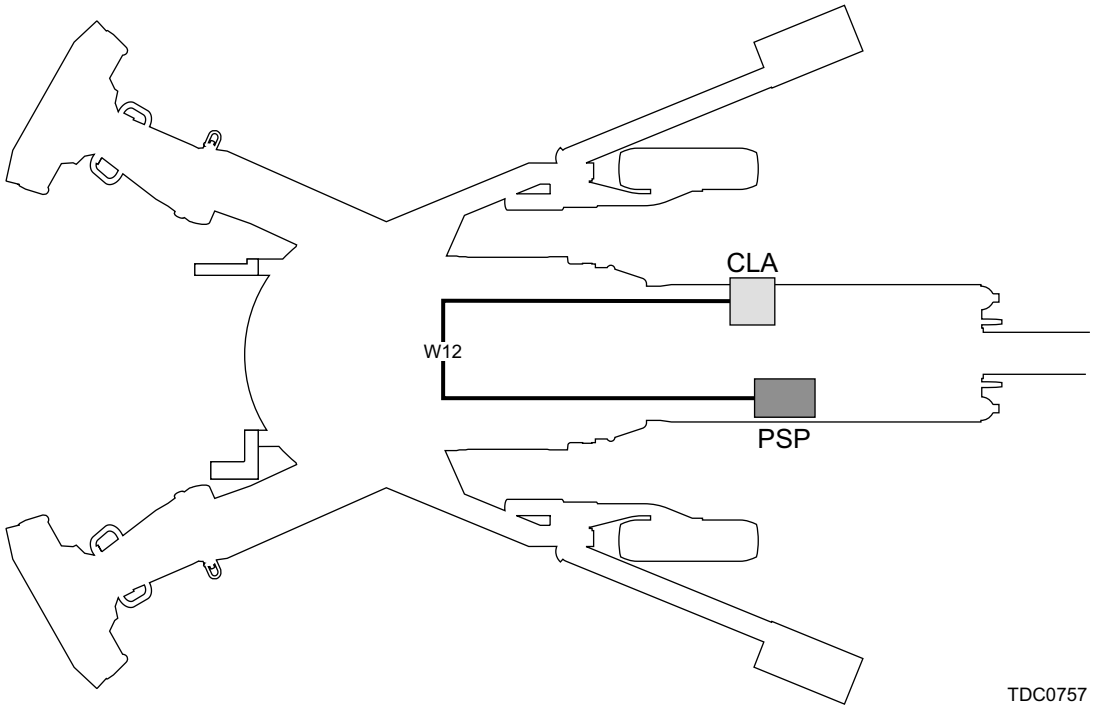


## 1-14 M777E1 HOWITZER DFCS CABLE ROUTING IDENTIFICATION (cont)

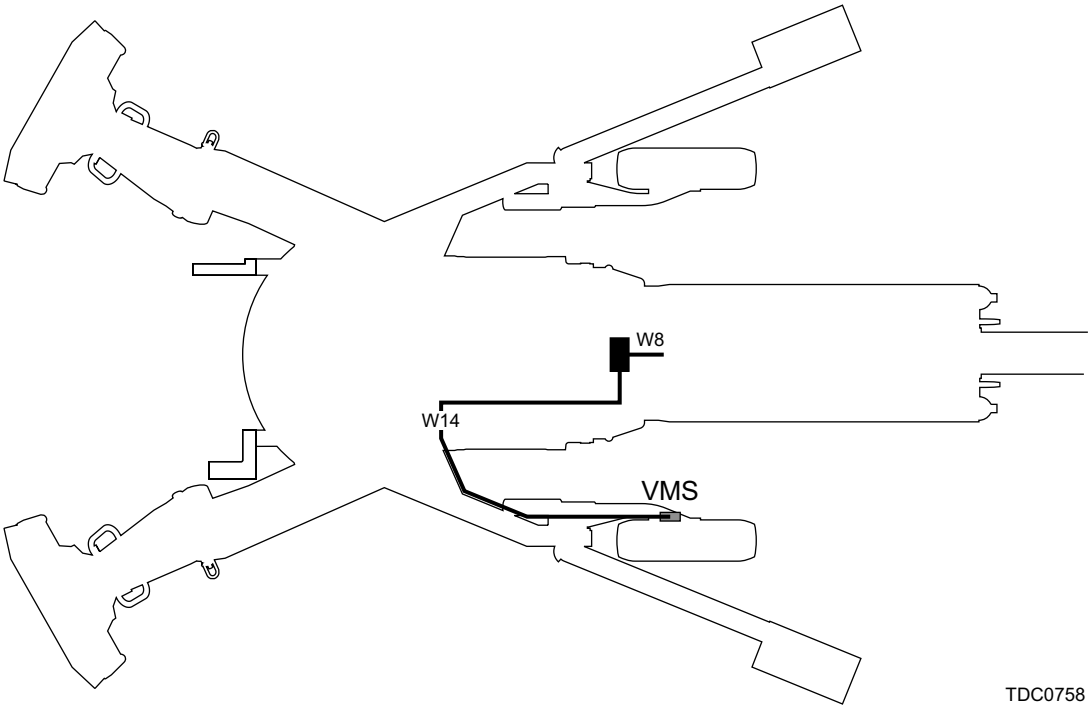
**(7)** [W11] cable – CLA to [W15] cable [J1] socket connection and ANT.



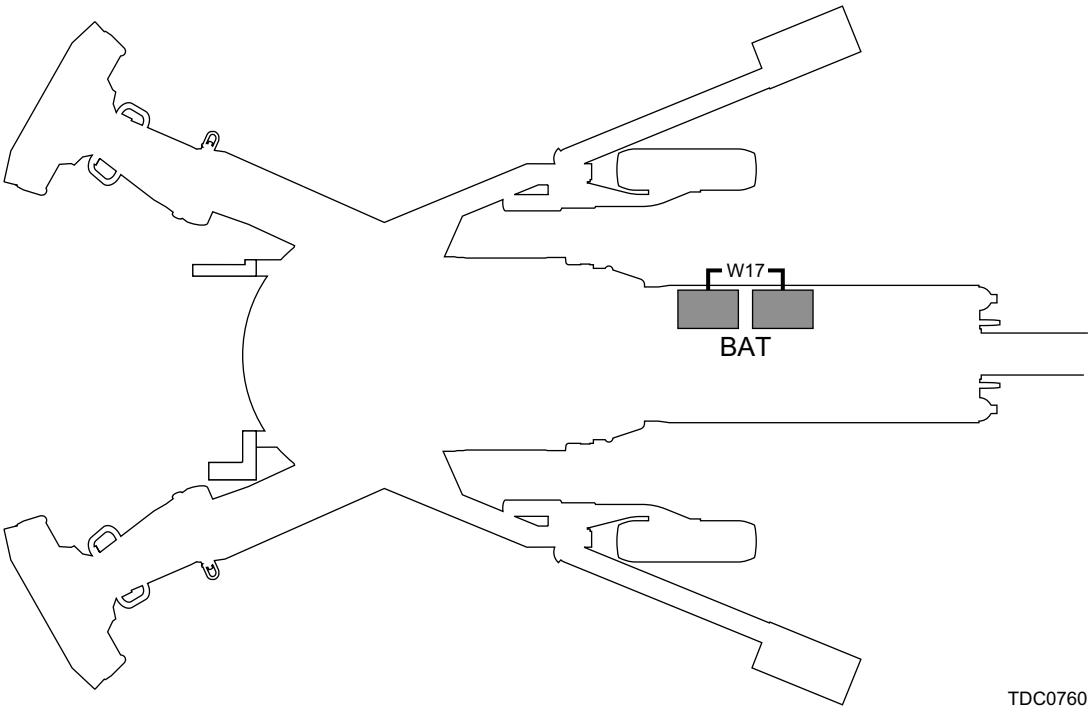

**(8)** [W12] cable – CLA to PSP.



**(9)** [W14] cable – VMS to [W8] cable [J1] socket connection.



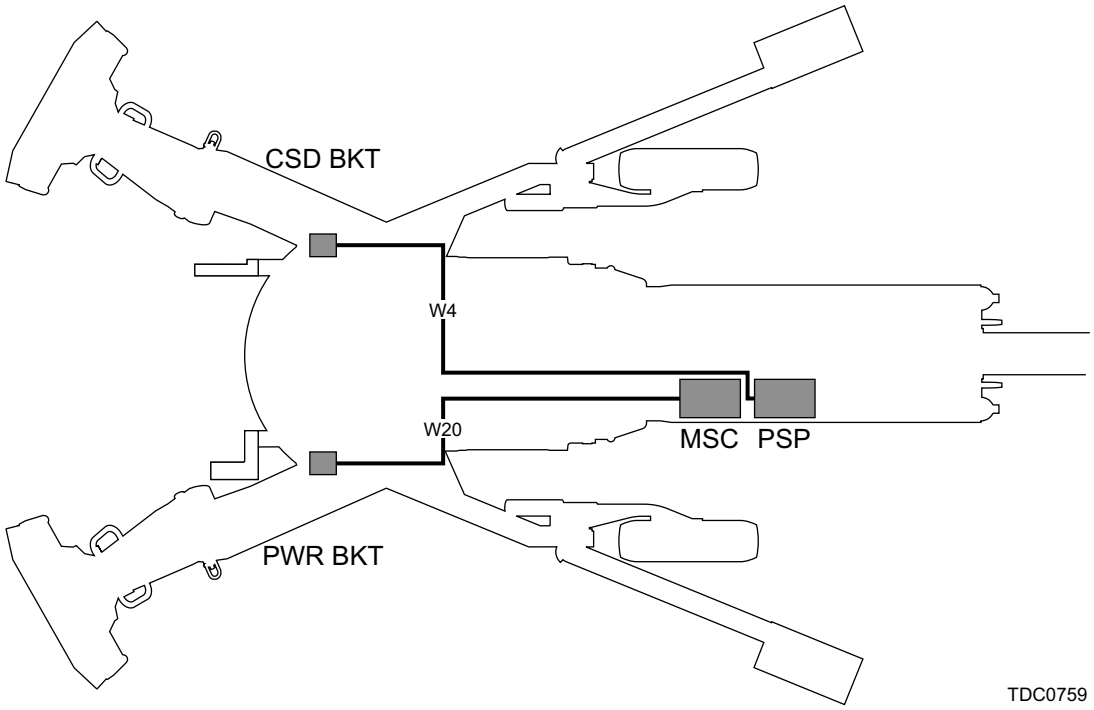

**(10)** [W17] cable – AFT BAT to FWD BAT.



## 1-14 M777E1 HOWITZER DFCS CABLE ROUTING IDENTIFICATION (cont)

**(11)** [W4] cable – CSD BKT to MSC.

**(12)** [W20] cable – PWR BKT to PSP.




## 1-15 EQUIPMENT DATA

### a. Howitzer Performance Data

Brakes:
- Parking ..... Manually operated
- Service ..... Air/Oil power

Breech life ..... Original and five tubes

Breech type ..... Screw block, interrupted thread

Dimensions (travel conditions):
- Ground clearance at rear of body ..... 2 ft 3 in (0.66 m)
- Height at spades:
  - Towed position ..... 7 ft $2^{2}/_{3}$ in (2.65 m)
  - Stowed position ..... 5 ft 6 in (1.54 m)
- Length:
  - Firing position ..... 35 ft (10.21 m) (center traverse) 35 ft 4 in (10.83 m) (maximum traverse)
  - Towed position ..... 31 ft 2 ¼ in (9.51 m)
- Tread (center-to-center) ..... 7 ft 6½ in (2.30 m)
- Width:
  - Firing position ..... 12 ft 2½ in (3.72 m)
  - Towed position ..... 8 ft 6 in (2.59 m)

EFC rating.....TM 9-1000-202-14

| | Zone | EFC |
|---|---|---|
| | 8-S | 1.000 |
| | 8 | 0.500 |
| | 7 Red | 0.500 |
| | 7 White | 0.150 |
| | 3-6 | 0.075 |
| | 1-5 Green | 0.075 |
| M231 | 1 | 0.050 |
| M231 | 2 | 0.150 |
| M232 | 3 | 0.100 |
| M232 | 4 | 0.250 |
| M232 | 5 | 1.00 |

Handwheel load:
- Elevating..... 265 in-lb (30 N-m)
- Traversing ..... 106 in-lb (12 N-m)

Length of recoil (maximum)... 55 in (1385 mm) charge 8S (M203A1), 55.9 in (1420 mm) max metal-to-metal

Lunette load.....60 lb (27.21 kg) at a height of 2ft 7½ in (0.80 m)

Maximum ranges:
- M203 propelling charge 8 (RAP rd, M549A1) .....18.6miles (30000m)
- M3 propelling charge 2 thru 5 ..... 3 to 5.9miles (5000 to 9900m)
- M231 (MACS) propelling charge.....0 to 00miles (0 to 00m)

Maximum terrain slope ..... 10-degree cant

Maximum towing speeds:
- Cross country tracks .....Up to 15 mph (24 kph)
- Improved roads .....Up to 45 mph (74 kph)
- Secondary roads .....Up to 30 mph (50 kph)

Mils of movement per turn of handwheel:
- Elevating..... Approximately 10 mils
- Traversing ..... Approximately 10 mils

Muzzle brake ..... Double baffle

On-Carriage elevating range .....-43 mils (-2.5 deg) to +1275 mils (72 deg)

Primer feed mechanism..... Magazine feed; loads, fires and extracts primers

Prime mover .....5-ton (4536-kg) truck

Rate of fire:
- Maximum.....4 rounds/minute for 2 minutes
- Sustained .....2 rounds/minute (determined by the Thermal Warning Device (TWD))

Recoil mechanism ..... Hydro-pneumatic, constant, dependant

Speed shift range .....6400 mils (360 deg)

## 1-15 EQUIPMENT DATA (cont)

### a. Howitzer Performance Data (cont)

Tires (radial):
- Pressure ..... 95 psi (661 kPa)
- Size ..... 245 x 70 x 19.5
- Load range ..... H

Traversing range ..... 400 mils (22.5 deg) left and 400 mils (22.5 deg) right of center

Tube life ..... Based on wear factor (pullover gage reading) (Refer to TM 9-1000-202-14)

M777 howitzer weight (without basic issue items) ..... 9277 lb (4208 kg)

M777E1 howitzer weight (without basic issue items) ..... 9840 lb (4463 kg)

### b. Optical Fire Control (OFC) Equipment Performance Data

M17A1 Fire Control Quadrant:
- Correction ..... ± 95 mils (± 5 deg)
- Elevation ..... -280 to 1275 mils (-16 to 72 deg)
- Least increment reading (counters) ..... 1 mil (0.05 deg)
- Weight ..... 7.50 lb (3.40 kg

M18A1 Fire Control Quadrant:
- Correction ..... ± 95 mils (± 5 deg)
- Elevation ..... -280 to 1275 mils (-16 to 72 deg)
- Least increment reading (counters) ..... 1 mil (0.05 deg)
- Weight ..... 7.50 lb (3.40 kg

M171A1 Telescope and Quadrant Mount:
- Cross level adjustment:
  - Left ..... 178 mils (10 deg)
  - Right ..... 178 mils (10 deg)
  - Elevation ..... -270 to 1333 mils (-15 to 75 deg)
- Pitch level adjustment:
  - Aft ..... 178 mils (10 deg)
  - Fore ..... 178 mils (10 deg)
- Weight:
  - Adapter assembly ..... 3.25 lb (1.47 kg)
  - Mount ..... 75 lb (34.02 kg)
  - Optical instrument Support ..... 2 lb (0.91 kg)

M172A1 Telescope and Quadrant Mount:
- Boresighting:
  - Azimuth ..... ±18 mils (± 1.01 deg)
  - Elevation ..... ±18 mils (± 1.01 deg)
  - Cross level adjustment ..... ± 604 mils (±34 deg)
- Weight:
  - Adapter assembly ..... 4.75 lb (2.15 kg)
  - Mount ..... 27.50 lb (12.47 kg)

M137A2 Panoramic Telescope (Pantel):
- Field of view ..... 178 mils (10 deg)
- Movement:
  - Azimuth counter ..... (increasing clockwise) 6400 mils (360 deg)
  - Azimuth (deflection) ..... 6400 mils (360 deg)
  - Correction (Azimuth) ..... ±95 mils (± 5 deg)
  - Elevation ..... ±300 mils (± 17 deg)
  - Least increment reading (Azimuth) ..... 0.25 mils (0.01 deg)
- Power ..... 4X
- Weight ..... 19 lb (8.62 kg)

M138A1 Elbow Telescope:
- Elevation ..... 60 mils (3 deg)
- Field of View ..... 142 mils (8 deg)
- Power ..... 8X
- Weight ..... 8 lb (3.63 kg)

M154 Alignment Device: (ERLS Battery Powered LED Light Source)
- Batteries:
  - Quantity/Cell Size ..... 1 each/size “AA”
  - Voltage ..... 3 volts (each)
- Weight ..... TBD lb (TBD kg)

M1A2 Collimator with case: (ERLS Battery Powered LED Light Source)
- Batteries:
  - Quantity/Cell Size ..... 2 each/size “C”
  - Voltage ..... 3 volts (each)
- Weight ..... 31 lbs (14 kg)

M1A1 Gunners Quadrant with case: (not illuminated – no light source)
- Least increment reading ..... 0.1 mil
- Weight ..... 3.63 lb (1.65 kg)

**c. Digital Fire Control System (DFCS) Performance Data**

Mission Computer (MSC):
- Weight ..... 17.50 lb (7.94 kg)
- Height ..... 5.12 in. (13.02 cm)
- Length ..... 9.35 in. (23.33 cm)
- Width ..... 11.50 in. (29.21 cm)
- Input Voltage ..... 28 VDC (from PSP)

Power Conditioning and Control Module (PSP):
- Weight ..... 24.52 lb (11.12 kg)
- Height ..... 9.5 in. (24.1 cm)
- Length ..... 14.0 in. (35.56 cm)
- Width ..... 5.75 in. (14.61 cm)
- Input Voltage ..... 28 VDC (from BAT)

Battery (BAT):
- Weight ..... 44.14 lb (20.02 kg)
- Height ..... 6.34 in. (16.25 cm)
- Length ..... 9.75 in. (25.00 cm)
- Width ..... 6.34 in. (16.25 cm)

## 1-15 EQUIPMENT DATA (cont)

### c. Digital Fire Control System (DFCS) Performance Data (cont)

M94 Muzzle Velocity System (MVS) (Radar Head):
- Weight ..... (-0 model) 13.67 lb (6.2 kg) (-2 model) 13.23 lb (6.0 kg)
- Height ..... 11.97 in. (30.41 cm)
- Depth ..... 3.80 in. (9.65 cm)
- Width ..... 8.43 in. (21.41 cm)
- Input Voltage ..... 28 VDC (from PSP)

Muzzle Velocity System (MVS) Mount:
- Weight ..... 8.11 lb (3.68 kg)
- Height ..... 0.00 in. (0.00 cm)
- Length ..... 0.00 in. (0.00 cm)
- Width ..... 0.00 in. (0.00 cm)

Vehicle Motion Sensor (VMS):
- Weight ..... 0.99 lb (0.45 kg)
- Height ..... 10.14 in. (26.0 cm)
- Length ..... 6.65 in. (17.06 cm)
- Width ..... 9.56 in. (24.50 cm)
- Input Voltage ..... 5 VDC (from PNS)

Positioning Navigation System (PNS):
- Weight ..... 13.01 lb (5.90 kg)
- Height ..... 5.11 in. (13.1 cm)
- Length ..... 9.56 in. (24.5 cm)
- Width ..... 0.00 in. (0.00 cm)
- Input Voltage ..... 28 VDC (from PNS)

PNS Mount:
- Weight ..... 4.7 lb (2.13 kg)
- Height ..... 1.46 in. (3.75 cm)
- Length ..... 10.02 in. (25.7 cm)
- Width ..... 9.36 in. (24.0 cm)

Gunners Display (GND):
- Weight ..... 3.0 lb (1.36 kg)
- Height ..... 4.68 in. (12.0 cm)
- Length ..... 6.40 in. (16.40 cm)
- Width ..... 2.34 in. (6.0 cm)
- Input Voltage ..... 28 VDC (from MSC)

GND Mount:
- Weight ..... 6.7 lb (3.04 kg)
- Height ..... 12.87 in. (33.0 cm)
- Length ..... 17.32 in. (44.4 cm)
- Width ..... 4.45 in. (11.4 cm)

Assistant Gunners Display (AGD):
- Weight ..... 3.0 lb (1.36 kg)
- Height ..... 4.68 in. (12.0 cm)
- Length ..... 6.40 in. (16.40 cm)
- Width ..... 2.34 in. (6.0 cm)
- Input Voltage ..... 28 VDC (from MSC)

AGD Mount:
- Weight ..... 9.15 lb (4.15 kg)
- Height ..... 11.47 in. (29.4 cm)
- Length ..... 13.81 in. (35.4 cm)
- Width ..... 11.90 in. (30.5 cm)

Section Chiefs Control and Display Unit (CSD):
- Weight ..... 6.02 lb (2.81 kg)
- Height ..... 7.29 in. (18.50 cm)
- Length ..... 11.2 in. (28.44 cm)
- Width ..... 7.23 in. (10.75 cm)
- Input Voltage ..... 28 VDC (from PSP)

Radio Antenna (ANT):
- Height ..... 109 45 in (278.00 cm)
- Base Diameter ..... 5.00 in (12.7 cm)
- Weight ..... 11.6 lb. (5.26 kg)

ANT Mount:
- Weight ..... 2.65 lb (1.20 kg)
- Height ..... 7.49 in. (19.2 cm)
- Length ..... 6.36 in. (16.3 cm)
- Width ..... 3.5 in. (8.97 cm)

Receiver/Transmitter assembly (RTA):
- Weight (without battery) ..... 5.55 lb (2.52 kg)
- Height ..... 3.2 in. (8.2 cm)
- Length ..... 10.1 in. (25.9 cm)
- Width ..... 5.3 in. (13.6 cm)
- Input Voltage ..... 9 to 32 VDC

Radio Amplifier (AMP):
- Weight ..... 6.8 lb (3.1 kg)
- Height ..... 5.3 in. (13.4 cm)
- Length ..... 12.1 in. (30.7 cm)
- Width ..... 2.7 in. (6.9 cm)
- Input Voltage ..... 9 to 32 VDC

Radio Power Supply (RPS):
- Weight ..... 0 lb (0 kg)
- Height ..... 0 in. (0 cm)
- Length ..... 0 in. (0 cm)
- Width ..... 0 in. (0 cm)
- Input Voltage ..... 0 to 0 VDC

Communication Location Assembly (CLA) (Fully populated):
- Weight ..... 42.26 lb (19.17 kg)
- Height ..... 14.73 in. (37.7 cm)
- Length ..... 13.40 in. (34.36 cm)
- Width ..... 14.74 in. (37.8 cm)
- Input Voltage ..... 28 VDC (from PSC)

Communication Location Enclosure (CLE):
- Weight ..... 34.26 lb (17.81 kg)
- Height ..... 10.6 in. (27.18 cm)
- Length ..... 10.2 in. (26.15 cm)
- Width ..... 11.1 in. (28.46 cm)

## 1-15 EQUIPMENT DATA (cont)

### c. Digital Fire Control System (DFCS) Performance Data (cont)

Top Cradle Electronics Assembly Mount:
- Weight ..... 39.93 Ib (18.11 kg)
- Height ..... 12.87 in. (33.0 cm)
- Length ..... 53.24 in. (136.5 cm)
- Width ..... 14.98 in. (38.4 cm)

Under Cradle Electronics Assembly Mount:
- Weight ..... 115.85 Ib (52.55 kg)
- Height ..... 11.64 in. (29.85 cm)
- Length ..... 55.89 in. (143.3 cm)
- Width ..... 29.48 in. (75.6 cm)

Precision Lightweight GPS Receiver (PLG):
- Weight ..... 2.75 Ib (1.30 kg)
- Height ..... 2.6 in. (6.67 cm)
- Length ..... 9.5 in. (24.36 cm)
- Width ..... 4.1 in. (10.51 cm)
- Input Voltage ..... 9 to 32 VDC

PLG Antenna (PLA):
- Weight ..... 0 Ib (0 kg)
- Height ..... 0 in. (0 cm)
- Length ..... 0 in. (0 cm)
- Width ..... 0 in. (0 cm)
- Input Voltage ..... 0 to 0 VDC

CSD Stow Bracket:
- Weight ..... 2.95 Ib (1.34 kg)
- Height ..... 4.91 in. (12.6 cm)
- Length ..... 4.91 in. (12.6 cm)
- Width ..... 2.77 in. (7.1 cm)

Power Connection Bracket:
- Weight ..... 0.47 Ib (0.21 kg)
- Height ..... 4.91 in. (12.6 cm)
- Length ..... 4.91 in. (12.6 cm)
- Width ..... 2.77 in. (7.1 cm)

Data Cable Connector Bracket:
- Weight ..... 0.23 Ib (0.10 kg)
- Height ..... 3.55 in. (9.1 cm)
- Length ..... 3.55 in. (9.1 cm)
- Width ..... 2.77 in. (7.1 cm)

# Section III. TECHNICAL PRINCIPLES OF OPERATION

**Section Index**



## 1-16 PRINCIPLES OF OPERATION

**a.** The howitzer is a lightweight, split trail weapon.

**b.** For firing, the wheels are raised clear of the ground, the body and stabilizers support the weapon.

**c.** For large shifts in direction, a hydraulically operated suspension system quickly lifts the weapon clear of the ground, rotates or shifts the weapon to the new direction, and then lowers it back onto the ground.

**d.** The traversing and elevating mechanisms are manually operated.

**e.** The two pneumatic equilibrator cylinders are charged with compressed nitrogen gas.

**f.** The recoil mechanism is a hydro pneumatic constant dependant type with a variable recoil length.

**g.** The cannon is equipped with a muzzle brake to reduce recoil.

**h.** The breech mechanism assembly is hydraulically operated, and the weapon is manually loaded.

**i.** The weapon is equipped with an air-over oil hydraulic brake system.

## Section IV. SECTION DRILLS

### Section Index



### 1-17 GENERAL

The purpose of section drill is to improve the howitzer section through execution of assigned tasks and cross training of section personnel.

### 1-18 INSTRUCTIONS

**a.** Section drill must be conducted in silence, except for commands and reports. The section must be drilled until reaction to commands is quick, automatic and correct.

**b.** Battery officers will supervise the drill. Errors will be corrected immediately.

**c.** Duties should be rotated during training so that each crewman of the section can perform all duties within the section. Battery overhead personnel should also take part in section drill so that they can perform with a howitzer section, if required.

**d.** If the number of personnel falls below the 10-man crew, the reduced crew drill will be used (Para 1-26).

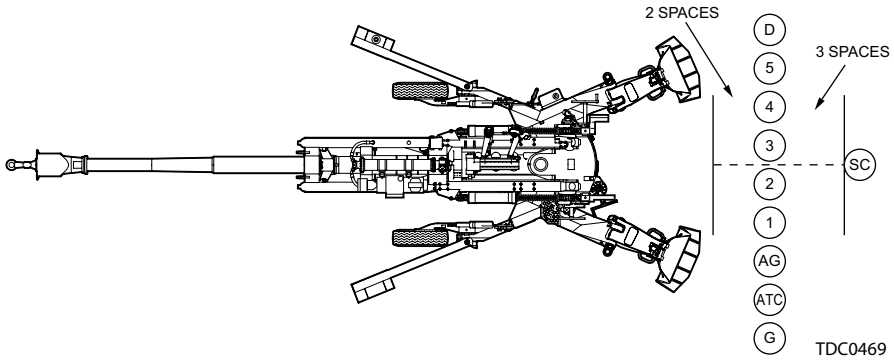
### 1-19 EXECUTION OF COMMAND TO FALL IN

**a.** To Fall In. The SC takes his assigned post. The preparatory command may indicate the place and direction in which the section is to form. At the first formation for a drill or exercise, the caution, HOWITZER SECTION, precedes the command. The commands are 1. FALL IN or 2. IN FRONT (REAR) OF YOUR PIECE, FALL IN.

**NOTE**

The formation for REAR OF YOUR PIECE is illustrated.

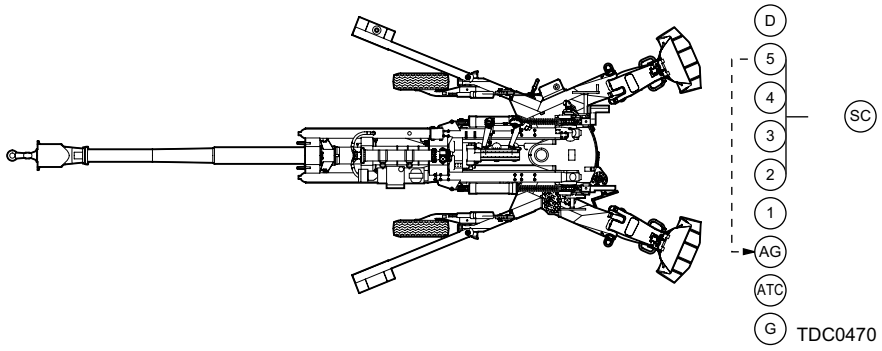
**b.** At the command, the section moves at double time and forms a single rank, at close intervals, guiding on the Gunner. The numbered Cannoneers should be in order between the Assistant Gunner and the Driver of the prime mover. The section stands at attention, centered on and facing the SC at a distance of three paces.




## 1-20 EXECUTION OF COMMAND TO CHANGE POSTS

**a.** To Change Posts. To have the Assistant Gunner and numbered Cannoneers change posts, the commands is 1. CHANGE POSTS, 2. MARCH.

**b.** At the command, the Assistant Gunner and numbered Cannoneers, except for ATC, take two steps left, taking the position of the next higher numbered Cannoneer. At the same time, Cannoneer No. 5 moves at double time to the rear of the rank to the post of the Assistant Gunner. All other crewmen stand fast.




## 1-21 EXECUTION OF COMMAND TO CHANGE POSTS (ENTIRE SECTION)

**a.** To have the entire section change posts, the command is 1. SECTION CHANGE POSTS, 2. MARCH.

**b.** At the command, all crewmen of the section take two steps left, except for the crewman on the extreme left, that crewman moves at double time to the rear of the rank and takes the post of the Gunner.

## 1-22 EXECUTION OF COMMAND TO CALL OFF

**a.** To Call Off. The command is CALL OFF.

**b.** All crewmen in rank, except the Gunner, execute eyes right.

**c.** The section calls off in sequence, GUNNER, AMMUNITION TEAM CHIEF, ASSISTANT GUNNER, CANNONEERS NOS. 1, 2, 3, 4 5, DRIVER. Each crewman calls out and turns head smartly to the front.

## 1-23 EXECUTION OF COMMAND TO MOUNT

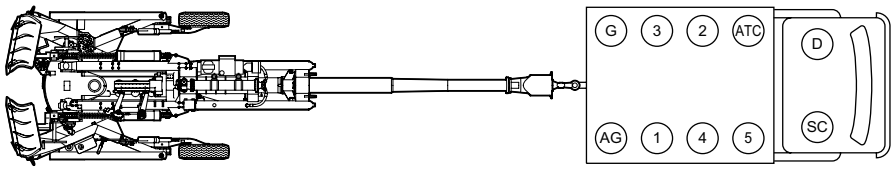
**a.** To Mount. To mount, the commands are 1. MOUNT or 2. PREPARE TO MOUNT, MOUNT. If any of the crewmen of the section are to remain dismounted, their designations are announced with the caution, STAND FAST, given between the preparatory command and the command of execution; for example, 1. PREPARE TO MOUNT; DRIVER STAND FAST, 2. MOUNT.

**b.** At the command, MOUNT, the section crewmen take positions as illustrated.

**c.** At the command of execution, the Driver and SC take their positions at the rear of the prime mover, on the left and right, respectively, where they can observe and assist in loading.

**d.** The two columns mount in order from front to rear and take seats as shown. Each Cannoneer is assisted in mounting by the person directly behind (or in front in the case of the last Cannoneer in the column) to ensure promptness and prevent injury.

**e.** Before mounting, the SC and Driver check that the howitzer is properly coupled, to the prime mover, with the brakes engaged, the crewmen are aboard, and the tailgate and safety straps are secure.



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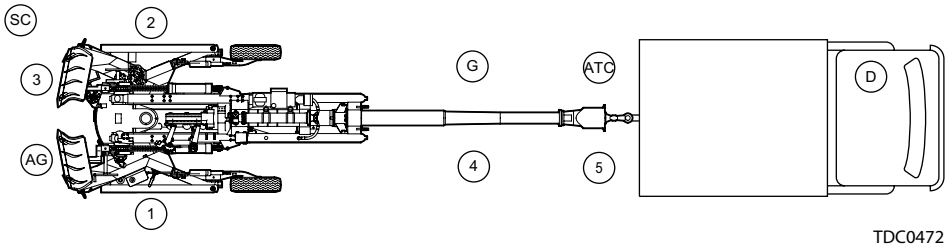
## 1-24 EXECUTION OF COMMAND TO DISMOUNT

**a.** To Dismount. The commands are DISMOUNT or 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

**b.** At the preparatory command, the personnel in the prime mover dismount from rear of the prime mover.

**c.** All crewmen of the section assume positions from which they can dismount properly.

**d.** At the command of execution, they dismount, and at double time, take the posts illustrated.



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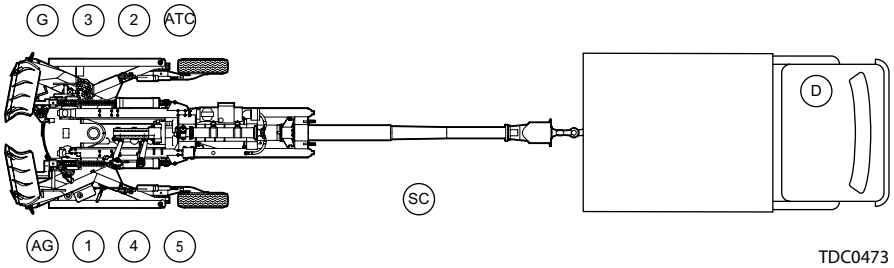
## 1-25 EXECUTION OF COMMAND TO POST

**a.** To Post. The command is 1. CANNONEERS, 2. POST. This general command applies whether the section is in, or out of ranks, at a halt, or marching.

**b.** At the command, the section moves at double time and takes the positions shown. The section then stands at attention.




## 1-26 BREAK PERIODS DURING TRAINING OR FIRING

**a.** At Drill. When it is required to give personnel a rest from drill or to relieve them temporarily from formation or posts, the command, FALL OUT, is given. The command may be given at any time and means that the section is to remain in the drill area.

**b.** When Firing. When firing has been suspended temporarily, but the section is to remain in the vicinity of the prime mover, the command, FALL OUT, is given. Crewmen stand clear of the howitzer, so that settings remain undisturbed. During these periods, the SC may direct the crewman to improve their position, to replenish ammunition, or to do other necessary work.

## 1-27 REDUCED CREW DRILL

**NOTE**

Procedures for operating with reduced crew have been standardized under the Department of the Army Standardization Program.

**a.** It is normal to expect howitzer crews to be reduced to less than the prescribed TOE strength due to illness, casualties, battery tasking, and the need to rest personnel. To meet the need of these occasions and the need to maintain operations of the section in as orderly a manner as possible, the duties of the individuals of the section have been combined as shown in.

**FIRING**

| 9-MAN | 8-MAN | 7-MAN |
|---|---|---|
| SC | SC | SC |
| G/ATC | G/ATC | G/ATC |
| AG | AG/1 | AG/1 |
| 1 | 2 | 2 |
| 2 | 3 | 3 |
| 3 | 4 | 4/5 |
| 4 | 5 | D |
| 5 | D | |
| D | | |

**1-27 REDUCED CREW DRILL (cont)**

**EMPLACEMENT/DISPLACEMENT**

| 9-MAN | 8-MAN | 7-MAN |
|---|---|---|
| SC | SC | SC |
| G | G | G |
| ATC | ATC | ATC |
| AG | AG | AG/1 |
| 1 | 1 | 2 |
| 2 | 2 | 3/5 |
| 3/5 | 3/5 | 4/D |
| 4 | 4/D | |
| D | | |

**b.** The SC will assign duties to the crewmembers when the number of available personnel falls below the level shown above.